Denture base materials

- **Requirements:**

Biocompatible, Readily cleansable

High flexural and impact strength, high modulus of elasticity (higher rigidity)

High abrasion resistance

Long fatigue life

High craze resistance and high creep resistance

High thermal conductivity

Low density, Low solubility and sorption of oral fluids

High softening temperature, dimensionally stable and accurate

Superior aesthetic and colour stability, Radiopaque

Good adhesion with teeth and denture liners

Ease of fabrication, inexpensive, Easily repaired

Heat-cured PMMA:

Has favourable working characteristics, acceptable aesthetics, physical and mechanical properties, easy to fabricate, inexpensive, BUT:

- **Undergo water sorption and loss**
- **Has low thermal conductivity**
- **Deform under load with time (low creep resistance). Reduced by the addition of cross-linking agents.**
- **Do not bond chemically with non-acrylic teeth.**
- **Water absorption causes colonization of candida.**

- Chemical composition of heat-cured PMMA:

Powder: prepolymerized PMMA beads

Initiator: benzoyl peroxide (0.5%)

Pigments and fibres

Liquid: Methyl methacrylate monomer

Inhibitor: Hydroquinone (traces)

Cross-linking agent: ethylene glycol dimethacrylate (10%)

Activator: N-N-dimethyl-p-toluidine

- Benzoyl peroxide yields free radicals that set off the chain reaction. Activation of the initiator can be achieved by heat, chemicals (tertiary amines), light or microwave radiation.

- **Polymerization reaction passes through activation and initiation, propagation and termination.**
- **Most denture bases used today are formed of heat-cured PMMA and copolymers (PMMA with polystyrene-butadiene rubber). Rubber improves impact strength.**
- **Polymers with chemical bonds between different chains (cross-linked). Improved rigidity, craze resistance and reduced solubility.**

Compression moulding technique:

Mix P/L = 3:1 by volume, or 2.5:1 by weight.

Sandy stage, tacky fibrous or sticky stage, doughy stage, stiff rubbery stage.

- **Polymerization reaction is exothermic, should be carefully controlled to avoid exceeding boiling point of unrecated monomer (100.8 C). Gaseous porosity due to rapid heating and evaporation of monomer, appears as fine pores in thick portions of dentures.**
- **Other causes of porosity: Insufficient pressure during flask closure, insufficient amount of dough, improper P/L or improper mixing.**
- **Porosity affects physical properties, aesthetics, hygiene.**

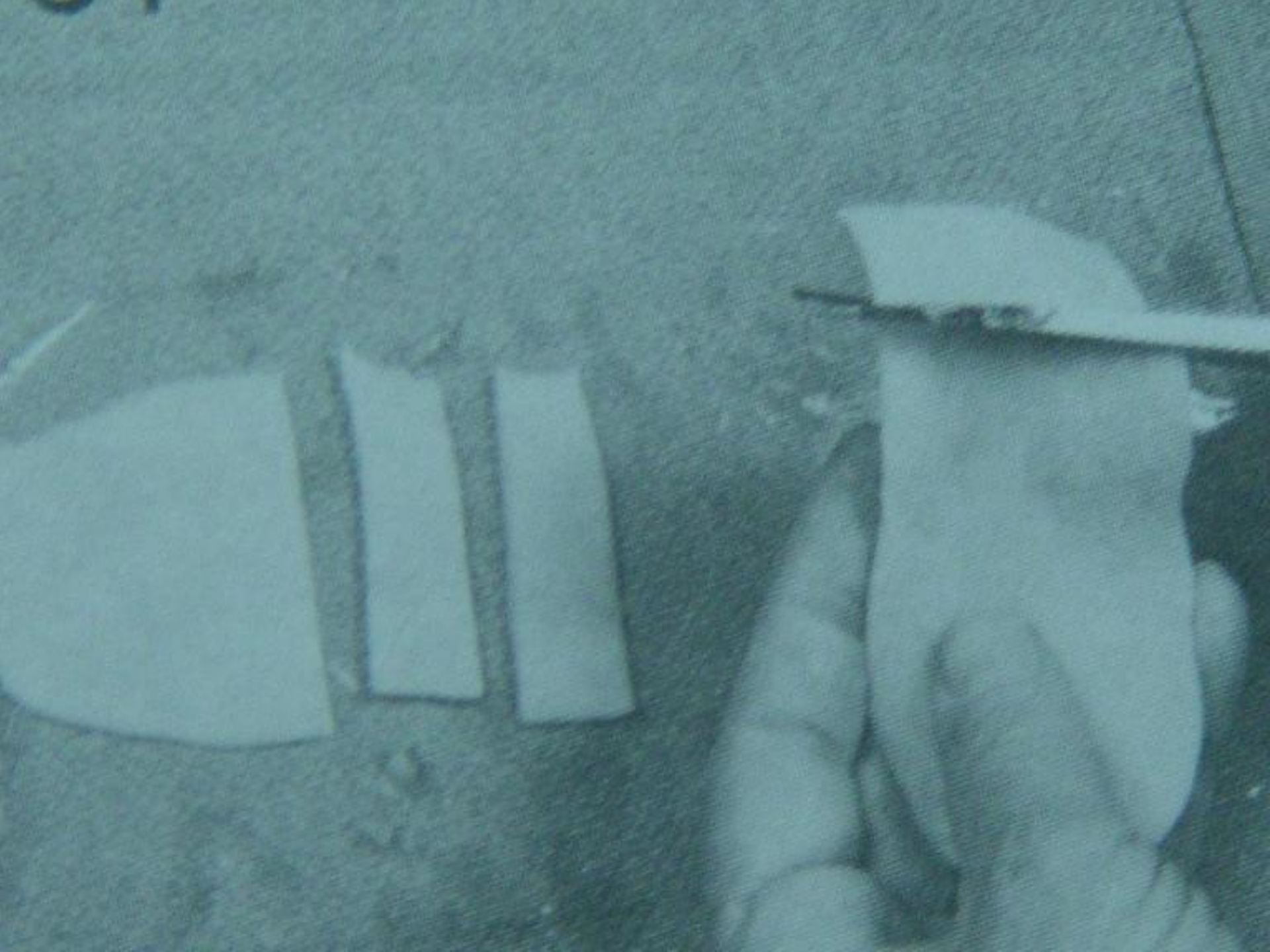
- Long cycle: Controlled constant temperature of 74 C for 8 hours or longer, sometimes followed by 2-3 hours of terminal boil at 100 C.
- Short cycle: 74 C for 2 hours then boiling for 1 hour at 100.
- Processing at low temperature or short time causes higher amounts of residual monomer, tissue irritation, sensitivity, allergic reactions, reduces strength and dimensional stability.
- Cool slowly at room temperature to allow release of internal stresses and minimize warpage.
- Compression moulding causes high processing stresses due to polymerization shrinkage (7% by volume), thermal shrinkage as the resin cools, differences in thermal contraction between gypsum and resin. These do not affect denture fit but cause occlusal inaccuracies.

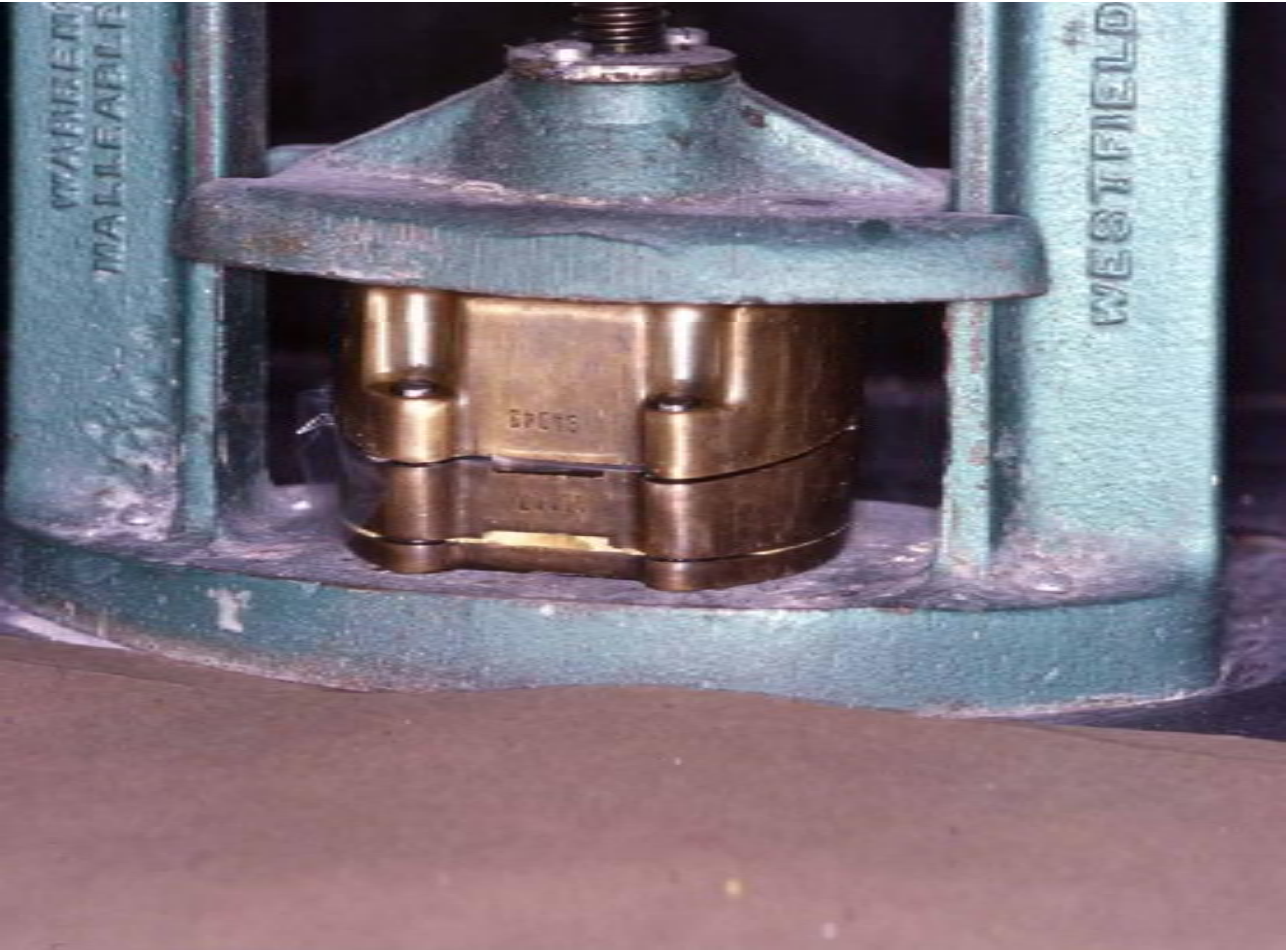
- **Other types of bases:**

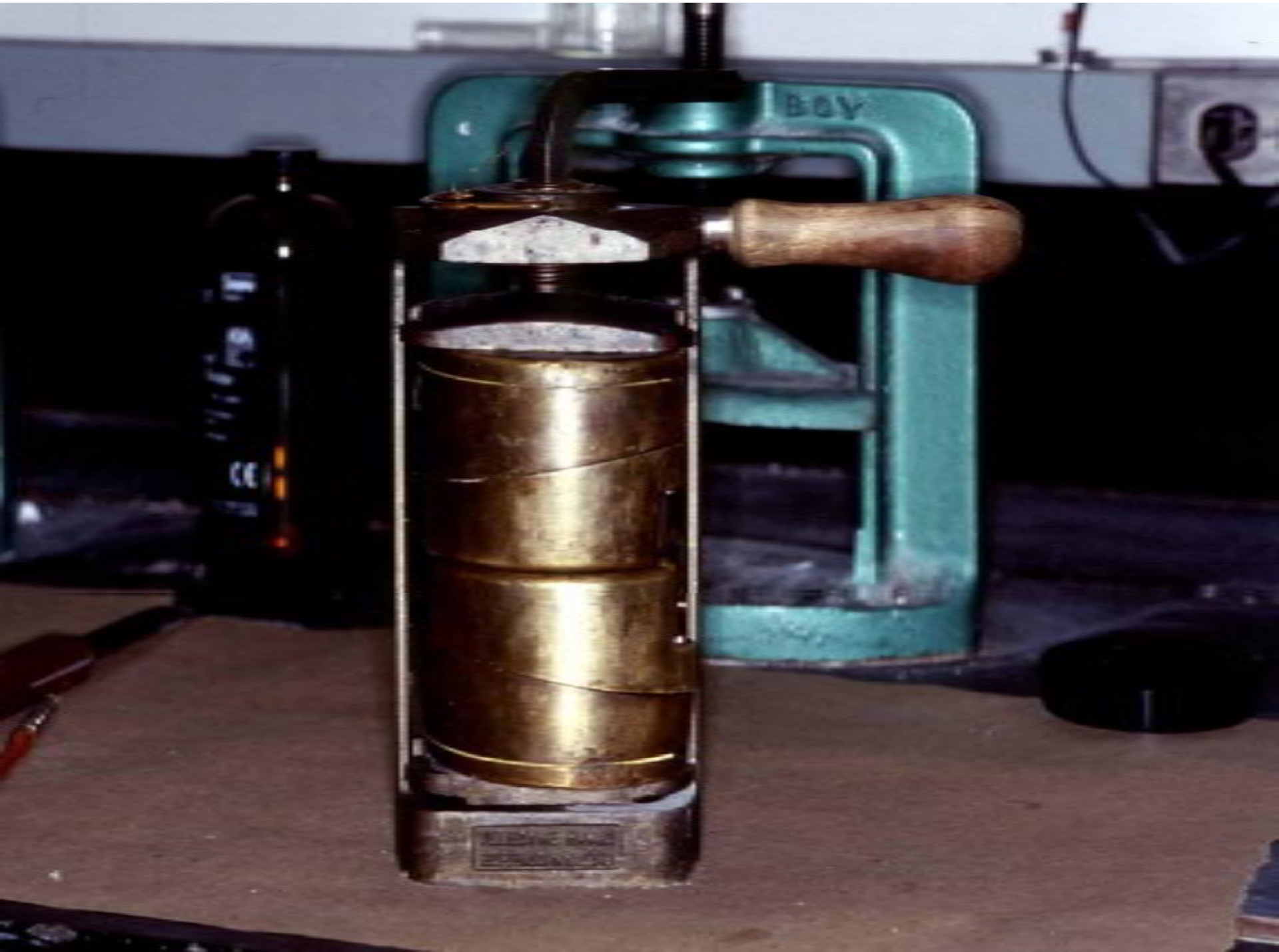
- **Injection moulding technique: The resin is injected in a closed sprued mould under continuous pressure resulting in minimal polymerization shrinkage.**
- **Chemically activated resins: Tertiary amine initiates the reaction. Not frequently used for denture bases, polymerzation in 30- 45 min, have higher residual monomer of 3-5%, compromised biocompatibility and mechanical properties, higher solubility, inferior colour stability, higher creep rates but less polymerization shrinkage.**
- **Microwave activated: Same composition, reaction in 3 min, comparable properties but more expensive.**

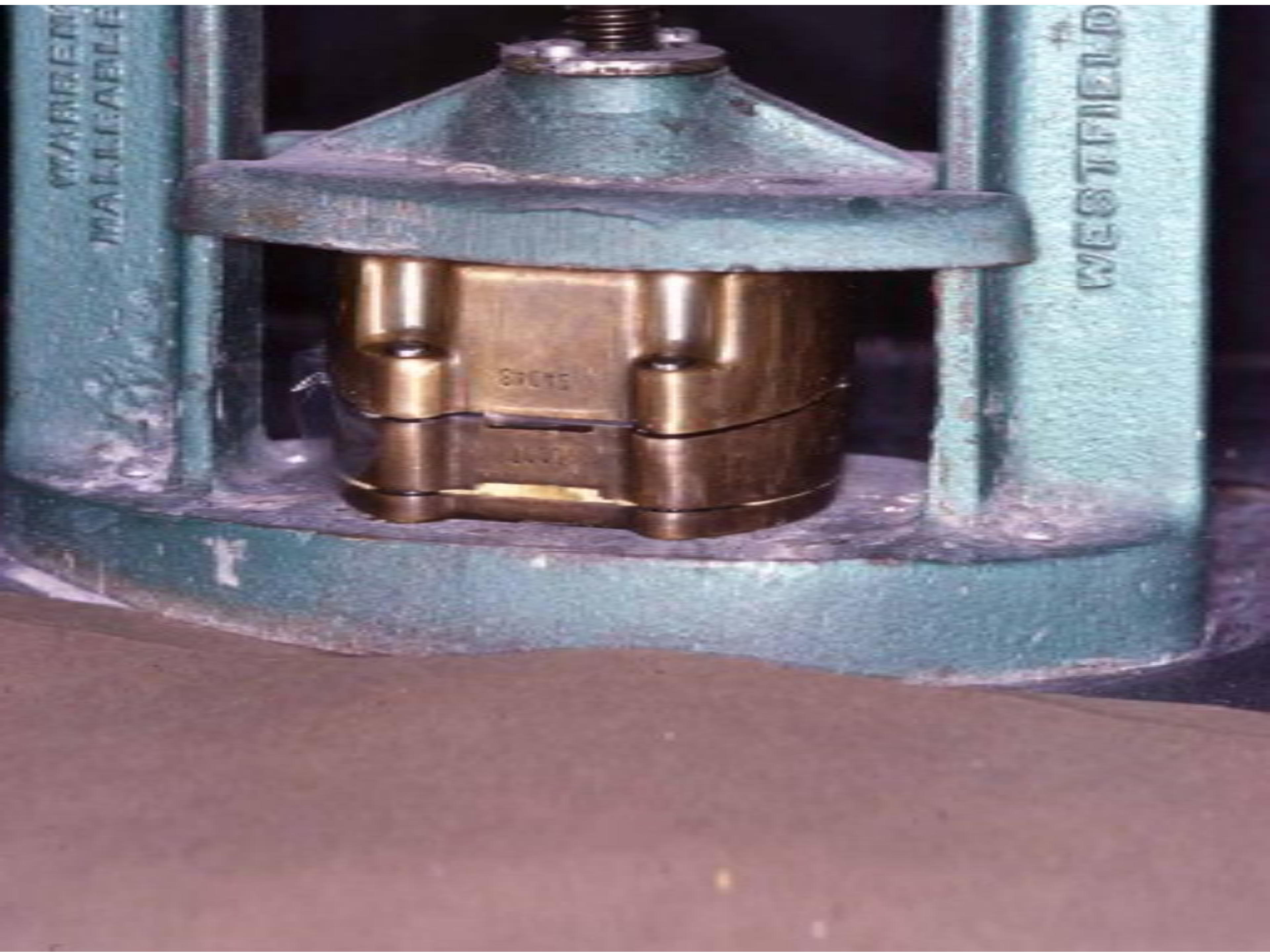
- **Light-activated bases: Copolymers of urethane dimethacrylcate and an acrylic resin copolymer. Curing with light at 400-500 nm. Photoinitiator: camphoroquinone-amine. Can be used with monomer-sensitive patients. Has reduced shrinkage, but slightly reduced mechanical properties and poor bonding with teeth.**
- **Mechanical reinforcement of resins by fibres (glass, carbon, kevlar and others) or metal inserts (wires, plates, fillers). But problems in tissue irritation from fibres, poor aesthetics, poor bonding with fibres, stress concentration from inserts, increased working time and handling difficulties.**
- **Improved radiopacity with the addition of salts such as barium sulfate and bismuth. Problems: Cytotoxicity, reduced strength and aesthetics.**

- **Wear gloves**
- **When doughy, make a roll and flatten between two pieces of plastic into 6 mm thick sheets, cut into pieces and place over the teeth in the flask**
- **Close the flask in a press and a sheet of separating plastic is placed in between until almost approximation**
- **Open flask, remove excess resin, and add resin where there was no flash excess**
- **Repeat until no flash excess is there**
- **Close flask without separating sheet**
- **Transfer flask into a the clasp, close tightly without compression to allow for resin to expand then shrink under pressure.**




WESTFIELD




MALLEABLE
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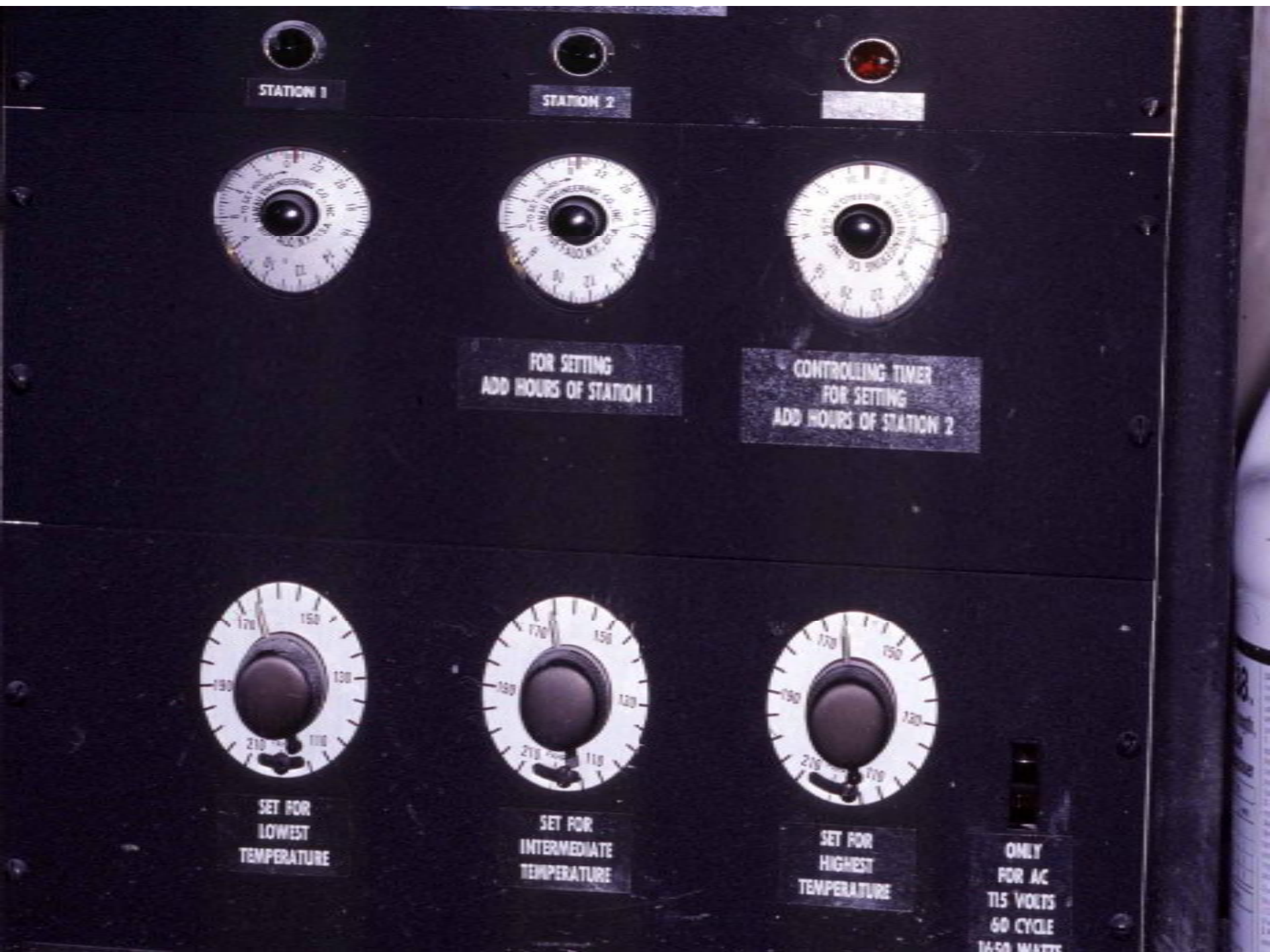

STATION 1
STATION 2
FOR SETTING
ADD HOURS OF STATION 1
CONTROLLING TIMER
FOR SETTING
ADD HOURS OF STATION 2
SET FOR
LOWEST
TEMPERATURE
SET FOR
INTERMEDIATE
TEMPERATURE
SET FOR
HIGHEST
TEMPERATURE
ONLY
FOR AC
115 VOLTS
60 CYCLE

Deflasking of the dentures

- **after processing the acrylic resin denture the flask is cooled slowly to room temperature.**
- **remove the lid of the flask by prying with a knife .**
- **place the flask in an ejector press.**
- **using minimum pressure eject the mold from the flask.**

- remove the stone cap (the third layer) by gently prying it off to expose the occlusal surfaces and incisal edges of the teeth.
- with a plaster saw make 4 cuts, 2 in canine region and 2 in the posterior region.
- with the plaster knife gently pry the sectioned plaster away from the facial surface of the teeth.
- after removing the outer sections of stone from the denture , trim the stone away from the lingual surfaces of the teeth before attempting to remove the inner section of plaster and stone. This procedure will

a-prevent breaking the teeth

b-prevent lifting the denture from the cast

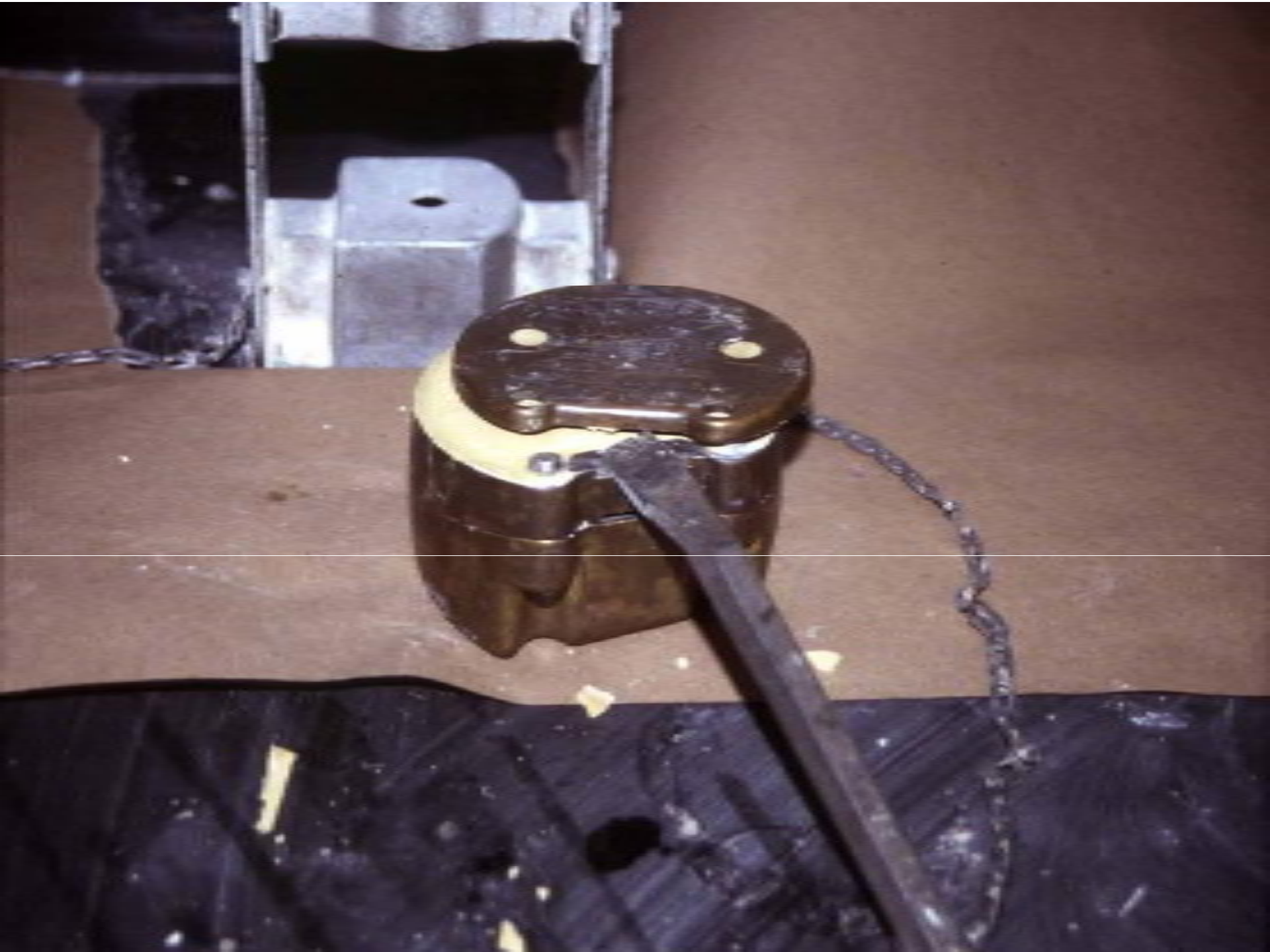
- During deflasking: be careful to preserve the cast, also do not left or remove the denture from the casts

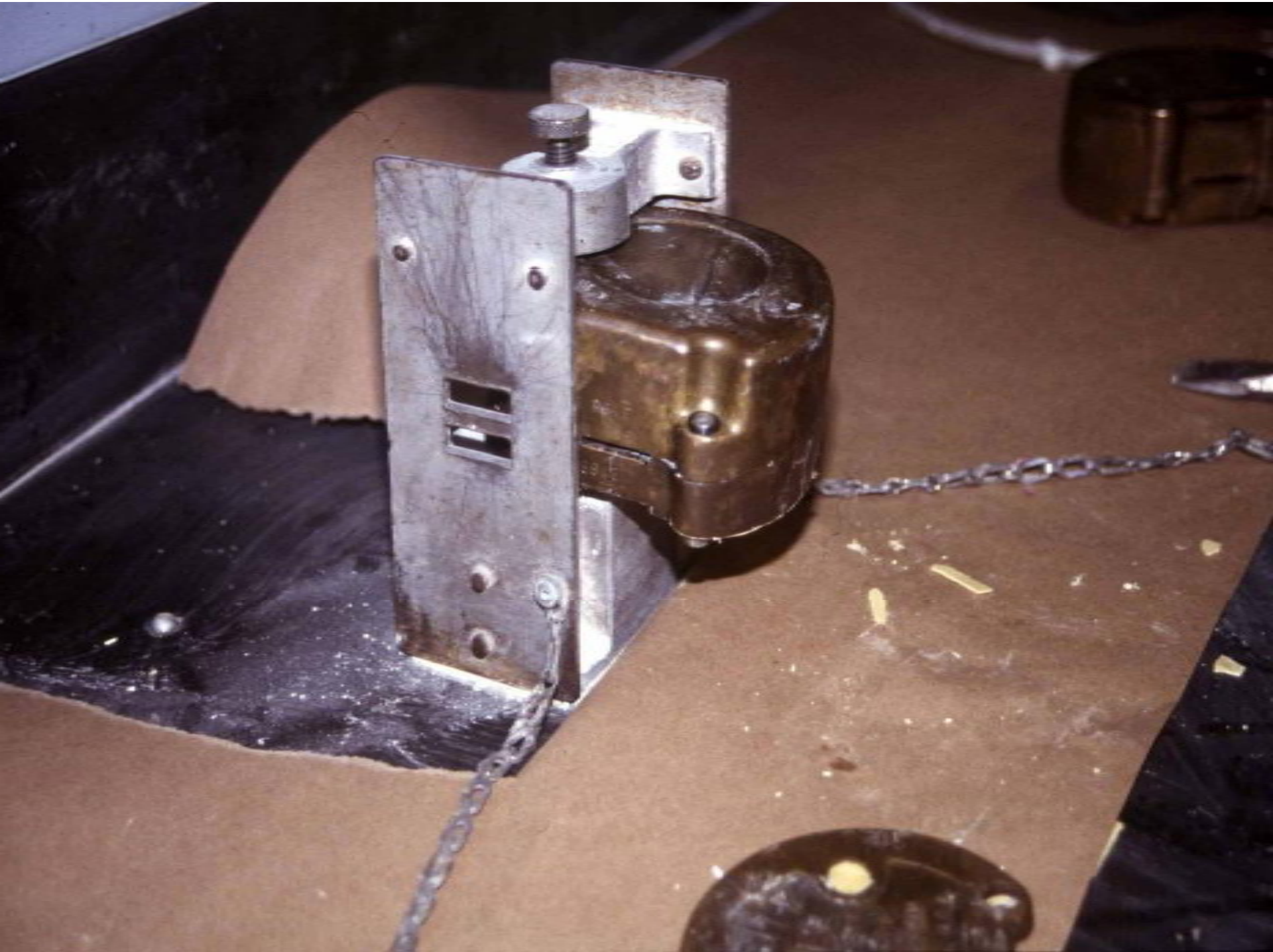
- **Clean the denture and cast from plaster.**

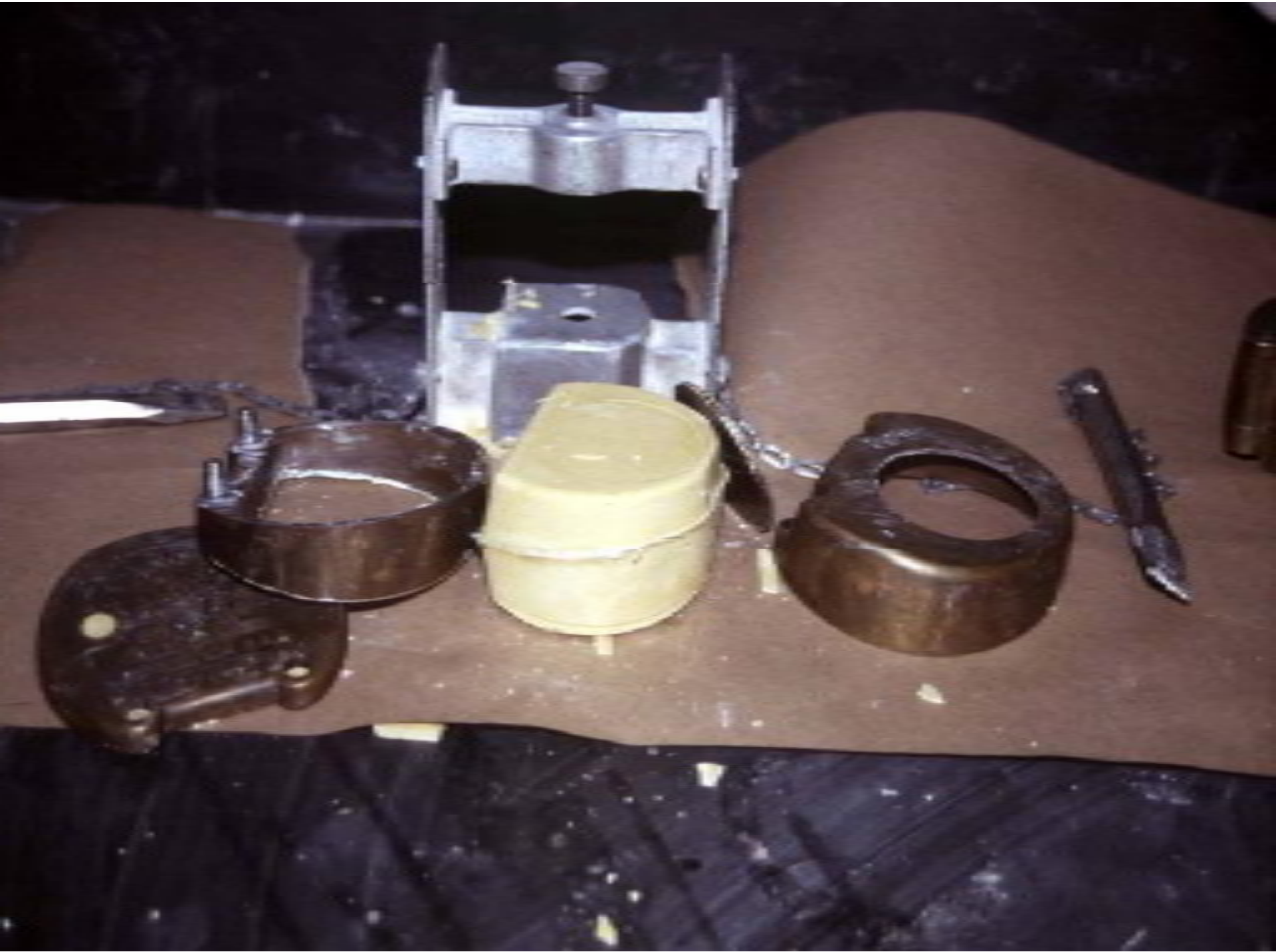
Remove any stone or bubbles from the exposed acrylic resin and from the occlusal surfaces of the teeth.

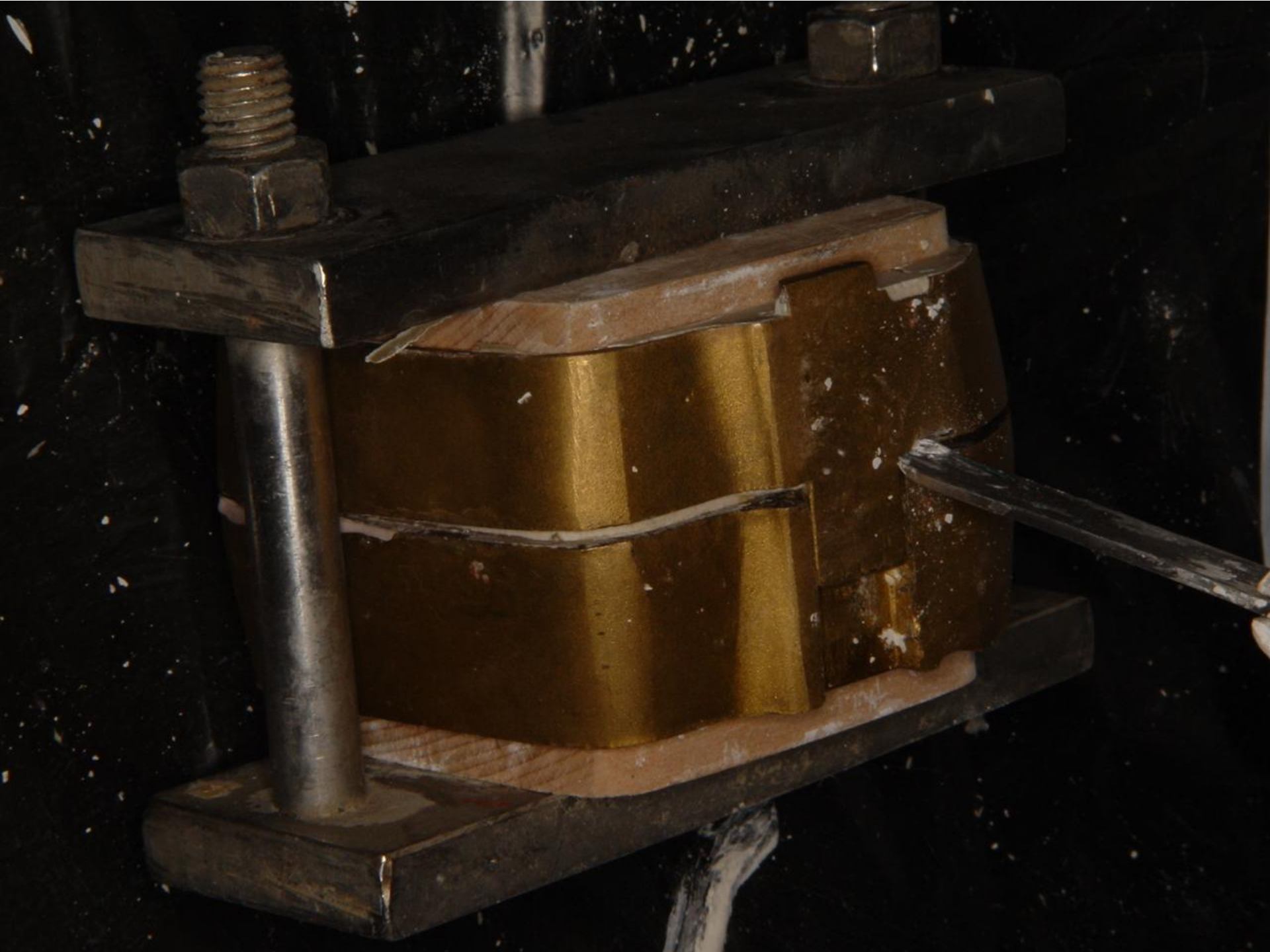
- **- Remove any particles of stone from the base of the cast and index grooves.**

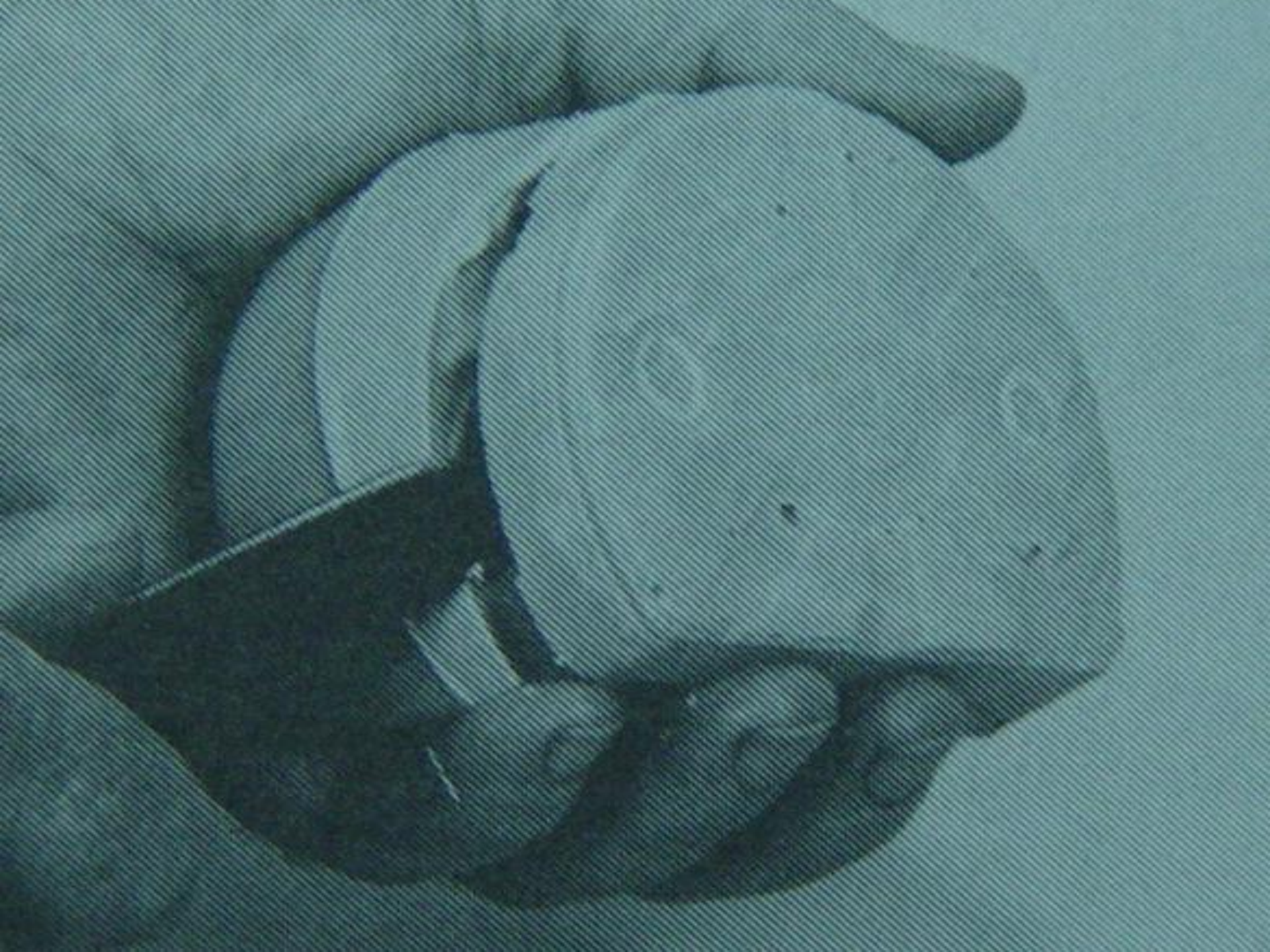
- Using a stiff brush , soap and water clean the denture and cast before starting the laboratory remount

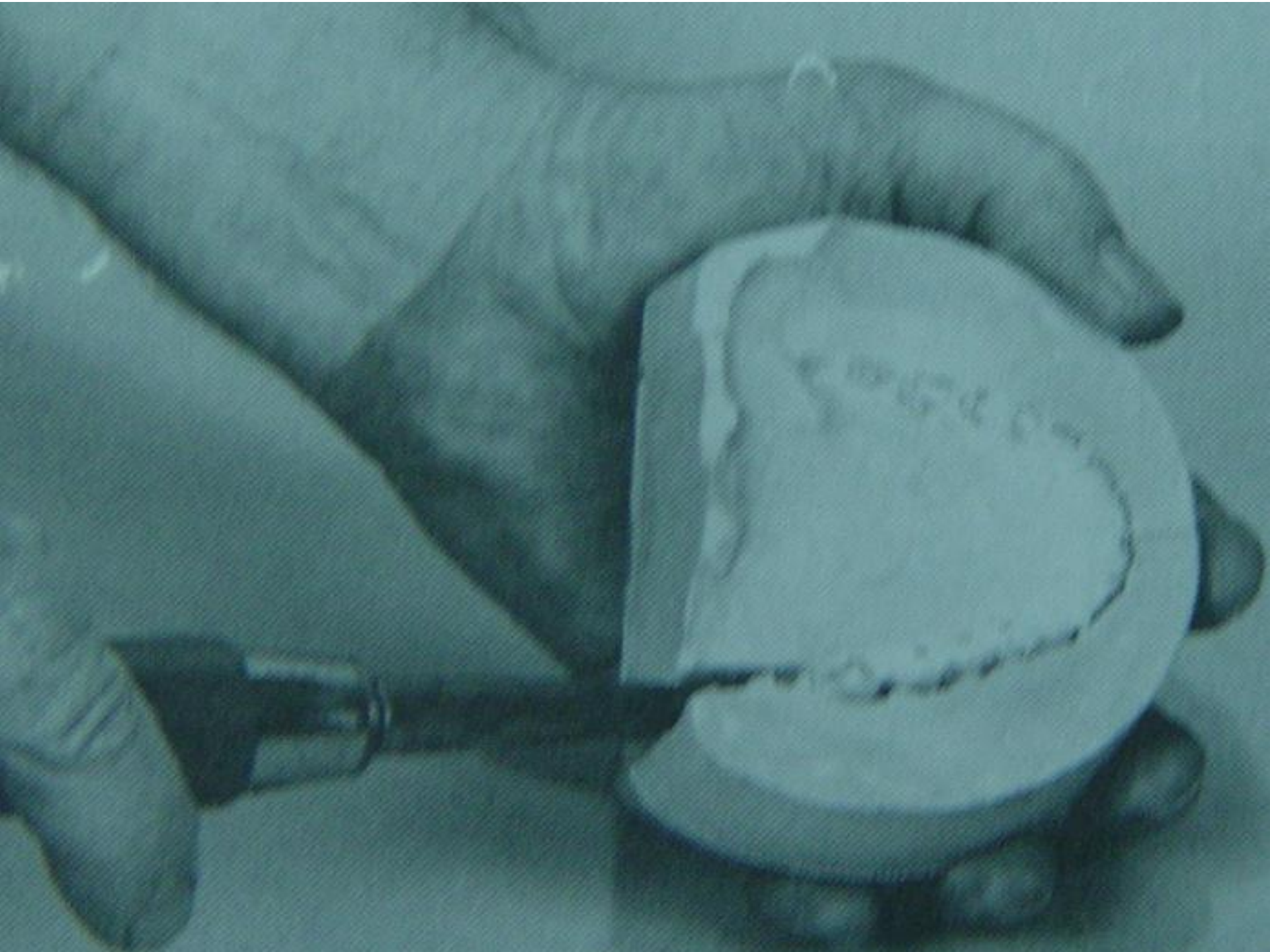




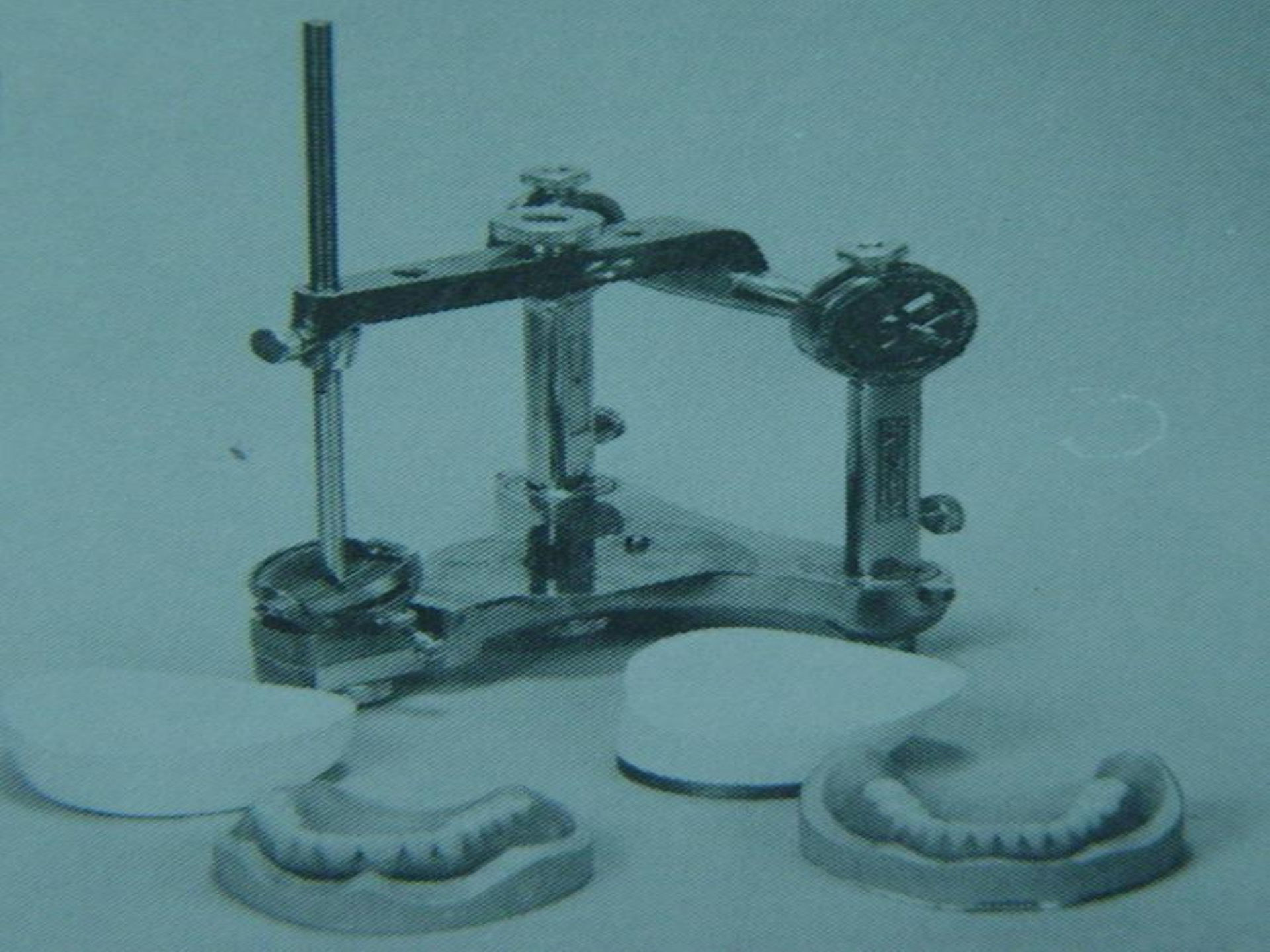








Selective Grinding and Milling

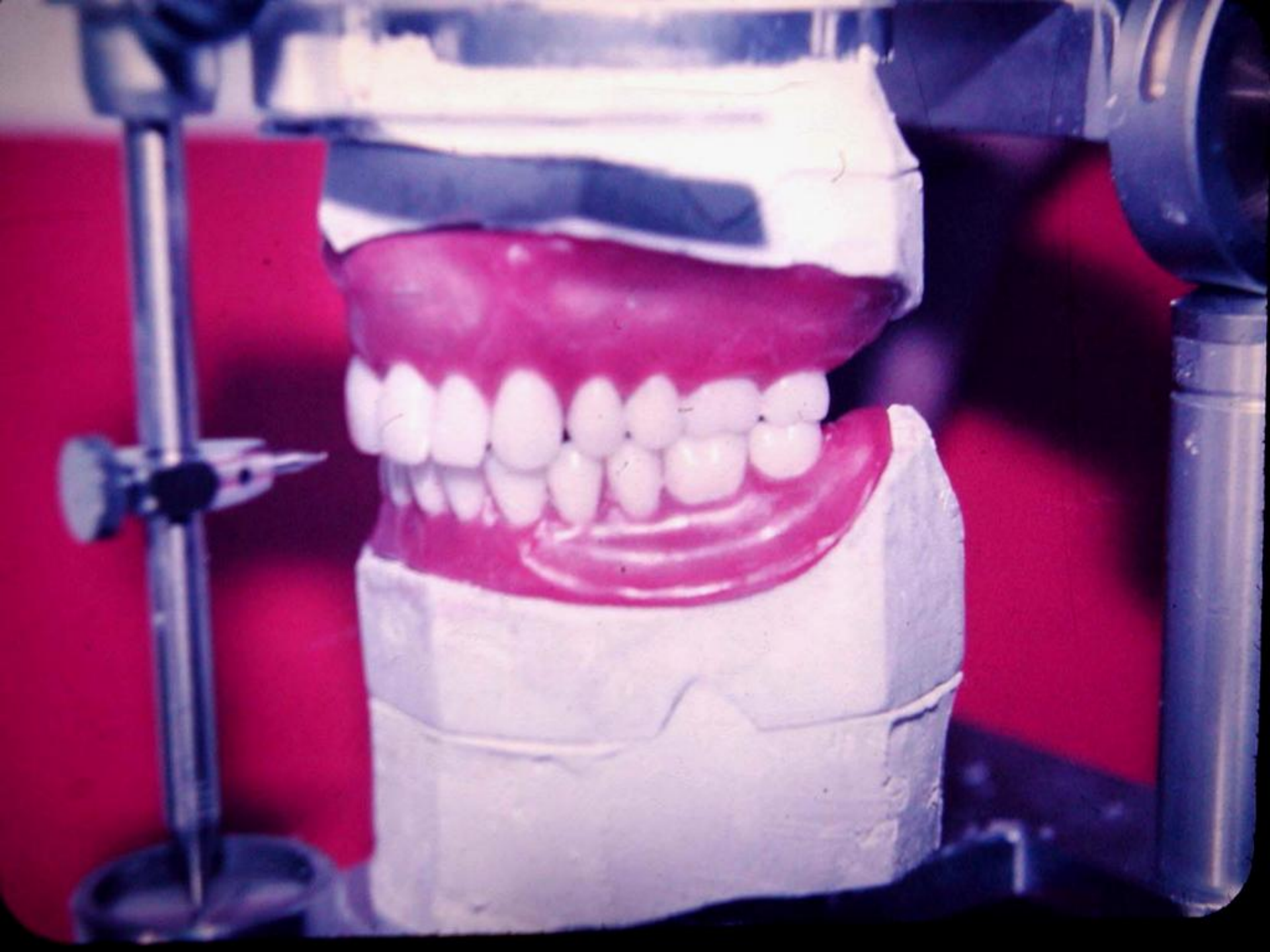


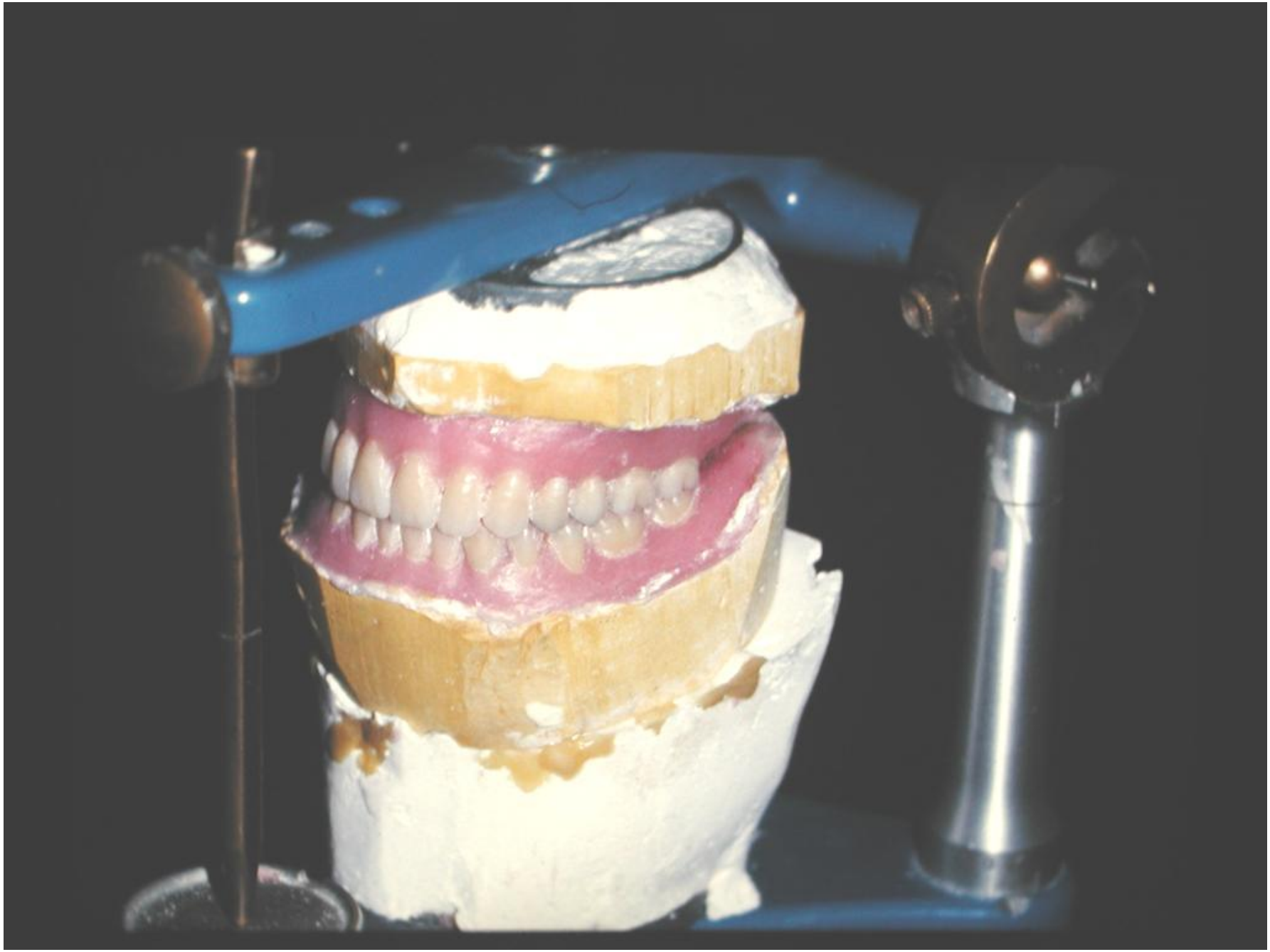
Sources of occlusal errors

- **Changes in the state of TMJs**
- **Inaccurate interocclusal records by the dentist.**
- **Errors in transferring relations to the articulator.**
- **Ill-fitting record bases**
- **Change of vertical dimension at articulator**
- **Incorrect arrangement of posterior teeth.**
- **Dimensional changes in the wax after setting up of the teeth. This should be very slight if the occlusion of the wax-up was carefully examined before flasking.**
- **Failure to close flasks completely during processing or use of too much pressure**

- **The expansion of the investing material during the processing.**
- **Polymerization shrinkage of resin and stress release at deflasking**
- **Heat generation at finishing and polishing**
- **Water sorption and expansion of dentures at use.**

In order to correct these errors, the dentures are returned to the articulator after deflasking. The casts are repositioned on the original plaster mountings using the key (index) in the base of the cast. The casts are attached to the plaster mountings by sticky wax





The condylar elements of the articulator are locked in the centric relation and the articulator is closed. If the incisal pin does not touch the incisal guide table the occlusal vertical dimension has been changed and must be re-established.

The sequence of steps should be as follows:

1. **Restore the vertical dimension.**
2. **Refine centric occlusion.**
3. **Perfect working and balancing occlusion.**
4. **Correct protrusive occlusion.**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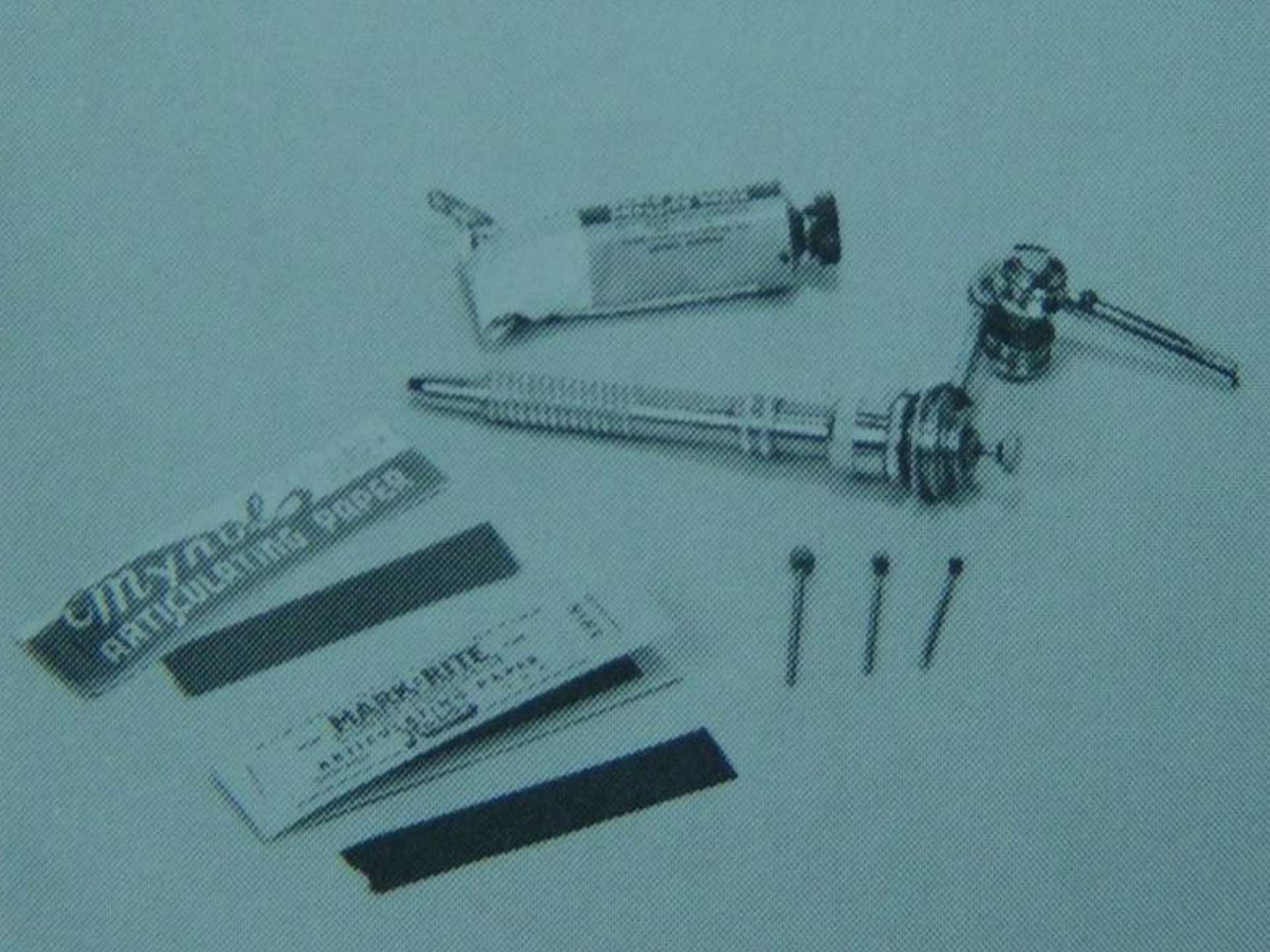
- Selective grinding is carried out using articulating paper to mark the area of premature contacts.

- Adjust the articulator to the proper setting.

Use red articulating paper for making centric occlusion and blue articulating paper for eccentric movements.

- Grind the teeth with small green or diamond stones.



Restore the vertical dimension:

A lateral shift of a tooth or a tooth shifted to produce a high cusp can increase the vertical dimension.

Do not grind the cusp tips unless it is high in every excursion, but rather reduce the fossa or inclined plane of the cusp.

Error: high cusp: grind the fossa.

Error: Lateral shift, buccal shift or lingual shift: grind the cusp inclines

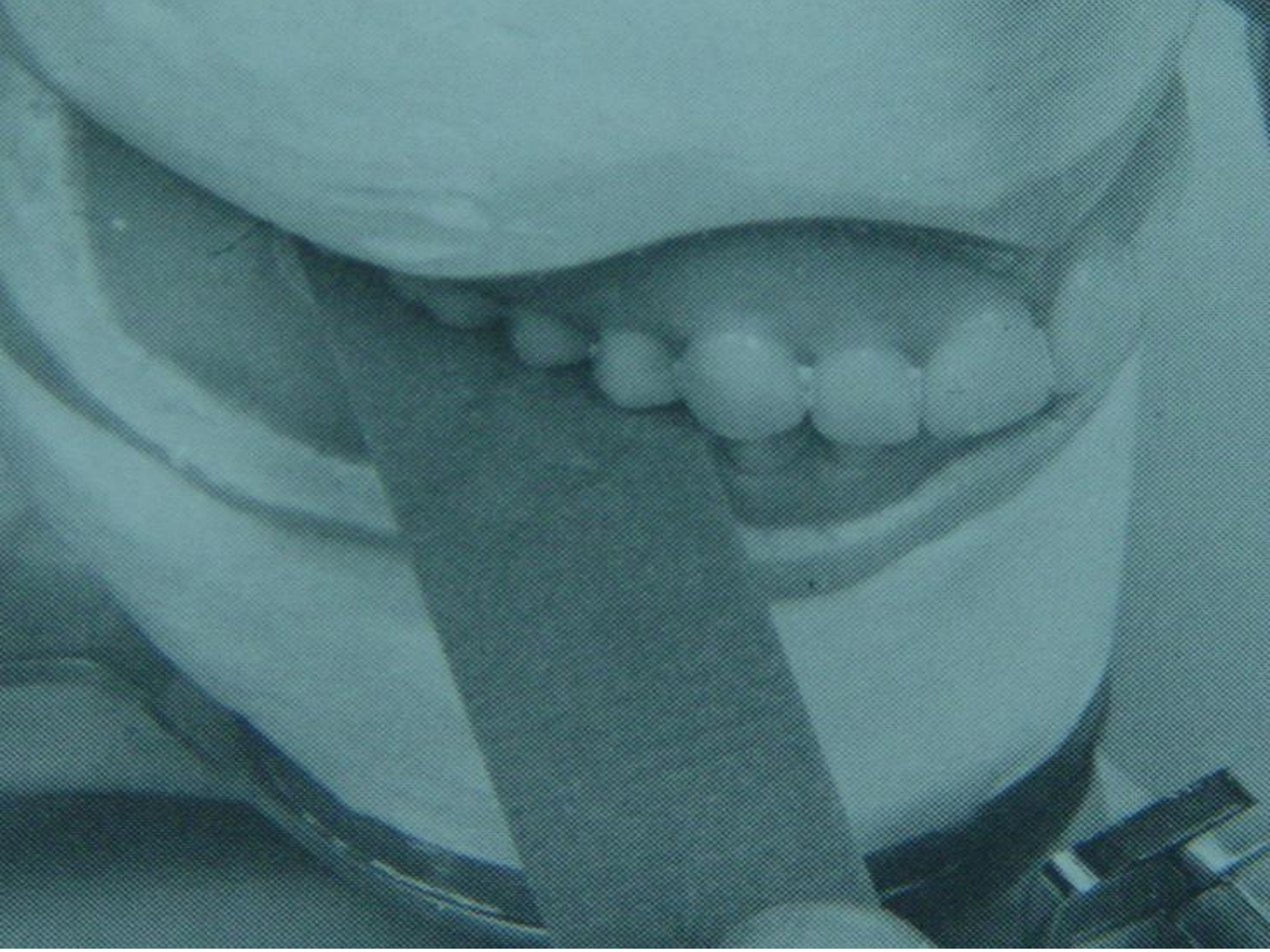
Obtain even contact in centric occlusion:

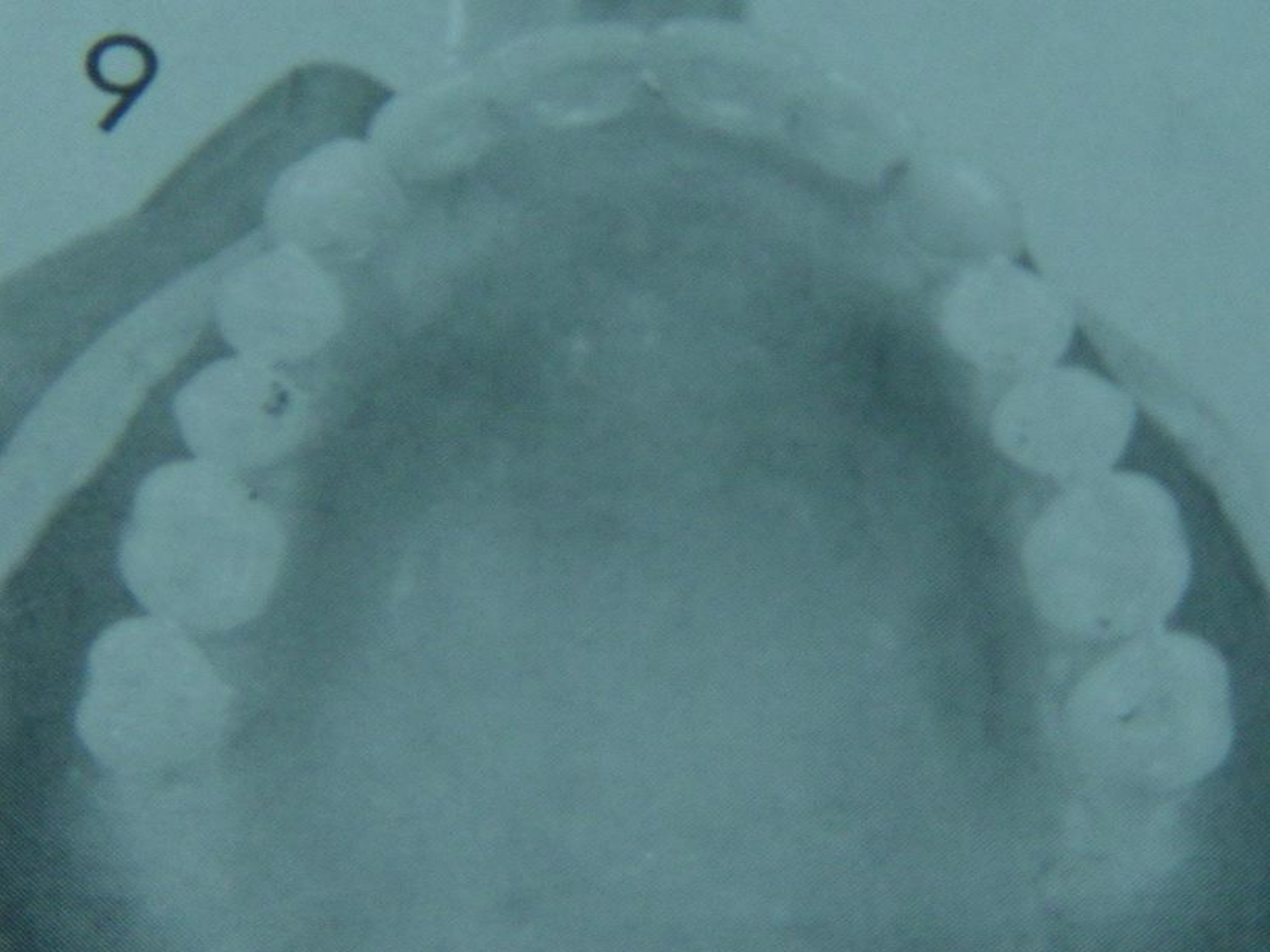
a. Lock the upper arm of the articulator in centric relation. Check the occlusion by opening and closing the articulator, and lightly tapping the teeth together on red articulating paper.

b. Loosen the locks on the condylar elements and move the denture in eccentric movements. Using blue articulating paper between the teeth.

- If the cusp is high in centric occlusion only, deepen the fossa.
- If the cusp is high in both centric and eccentric position, reduce the cusp.

Reduce the teeth until the incisal pin touches the incisal guide table and uniform contact exists on all posterior teeth. Anterior teeth should not touch in centric occlusion.

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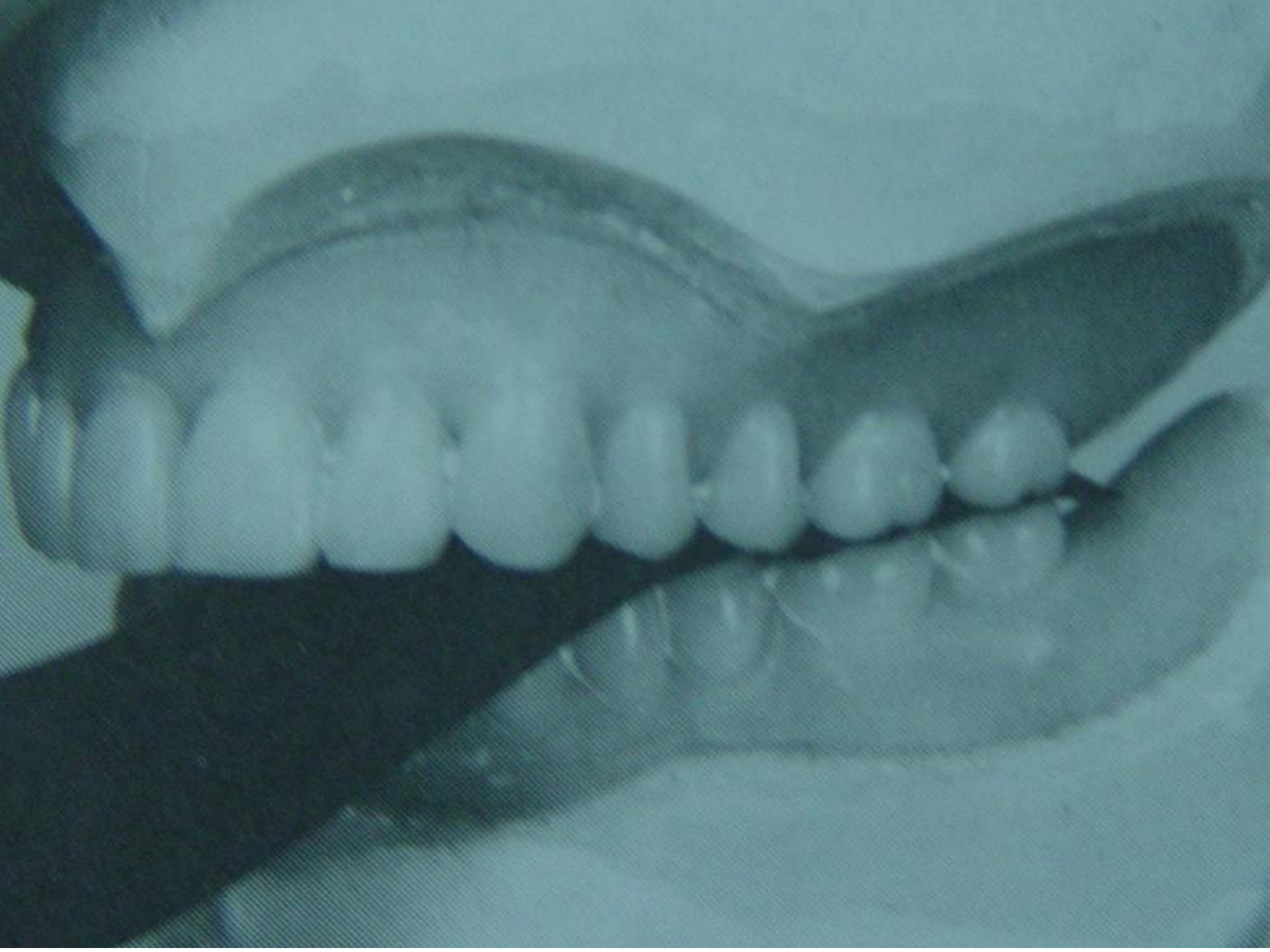

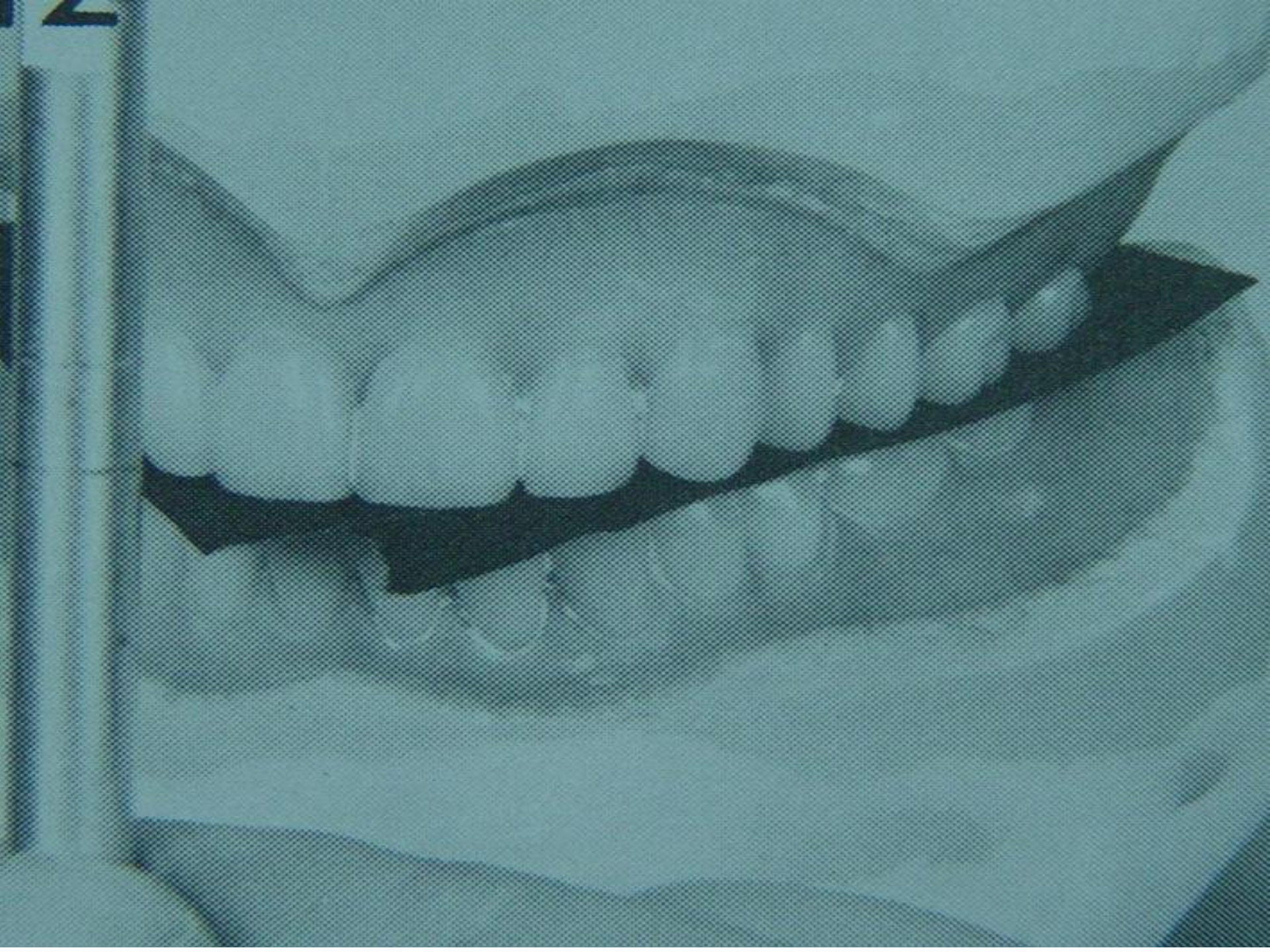

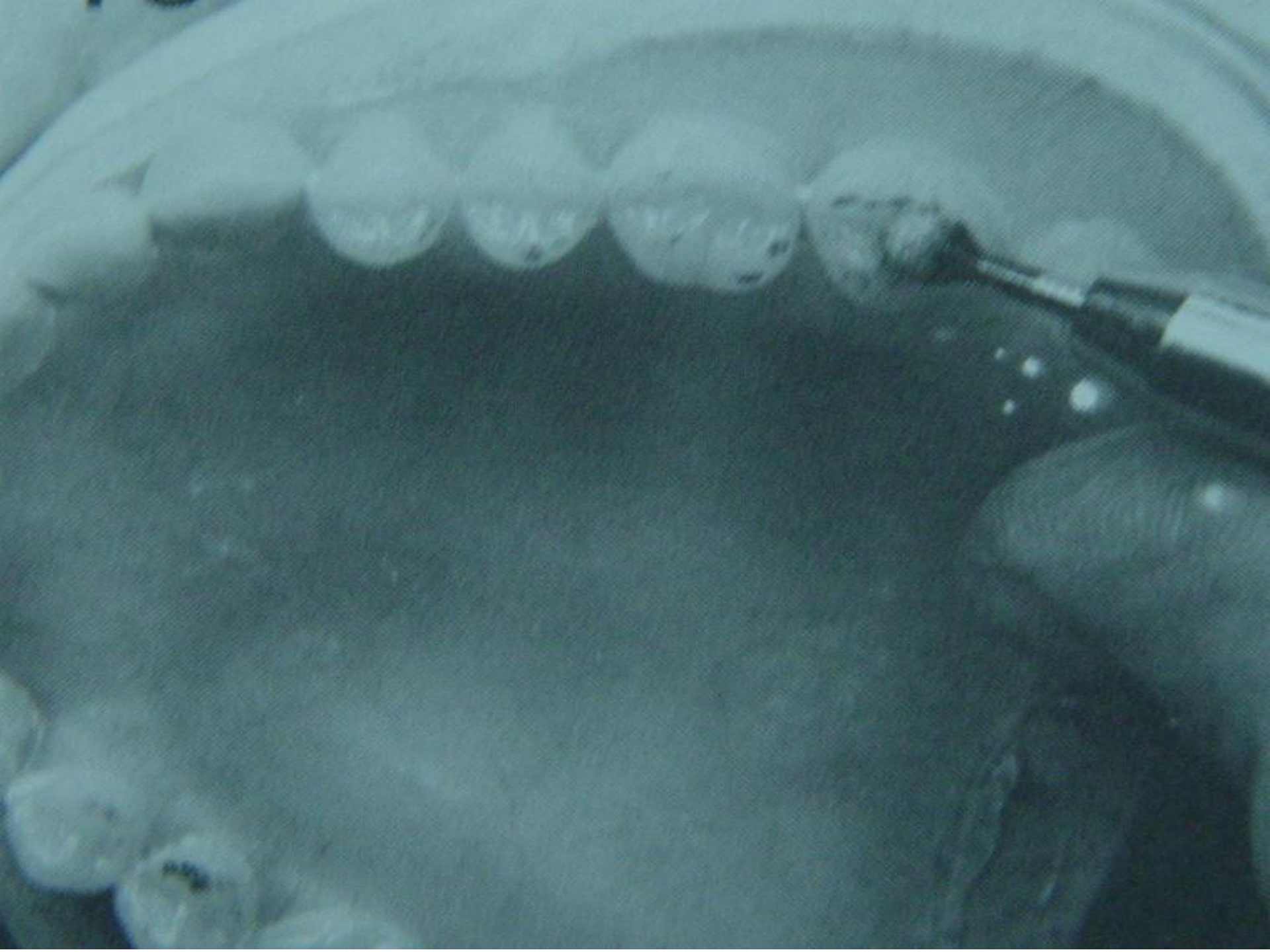

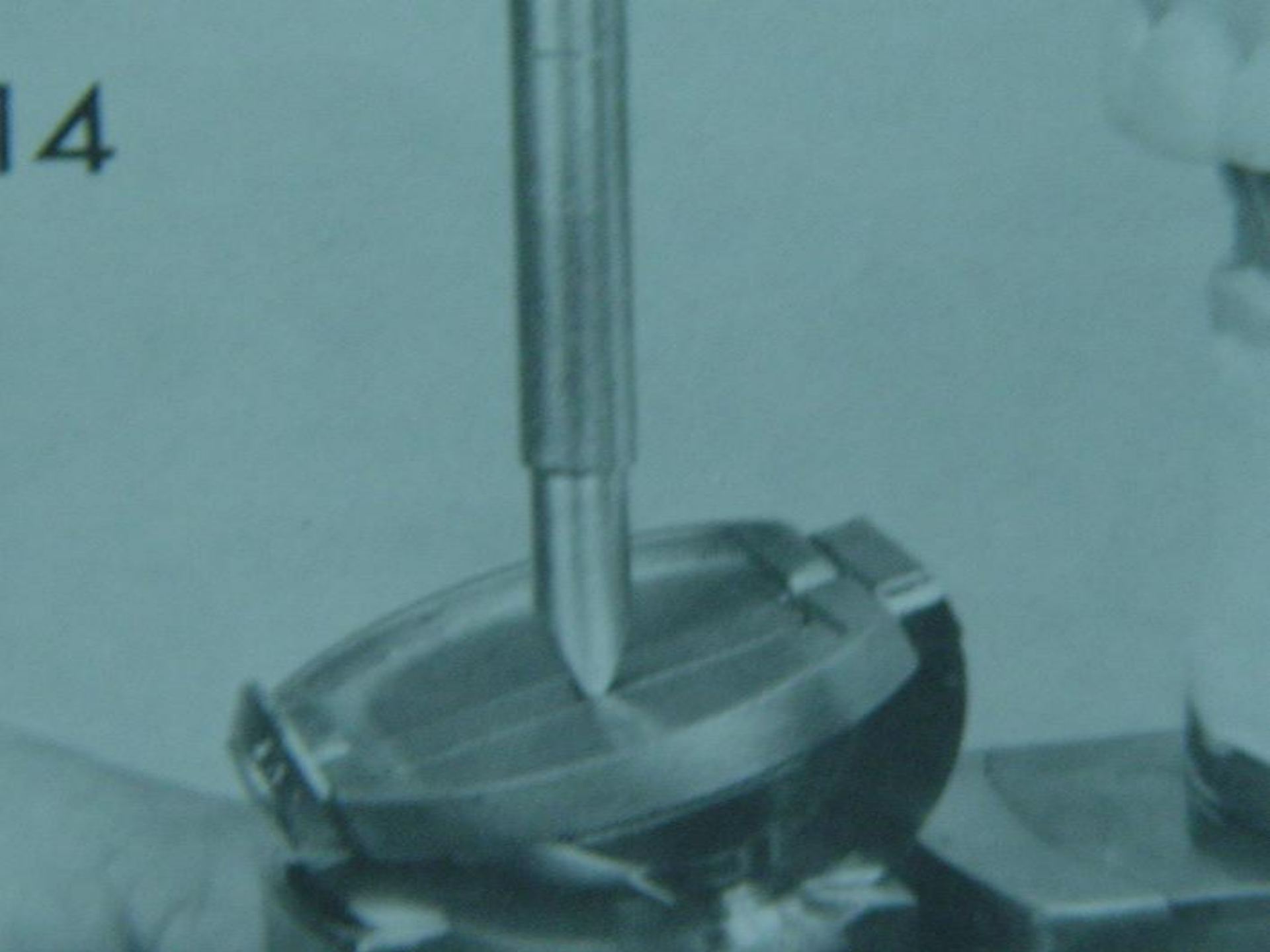

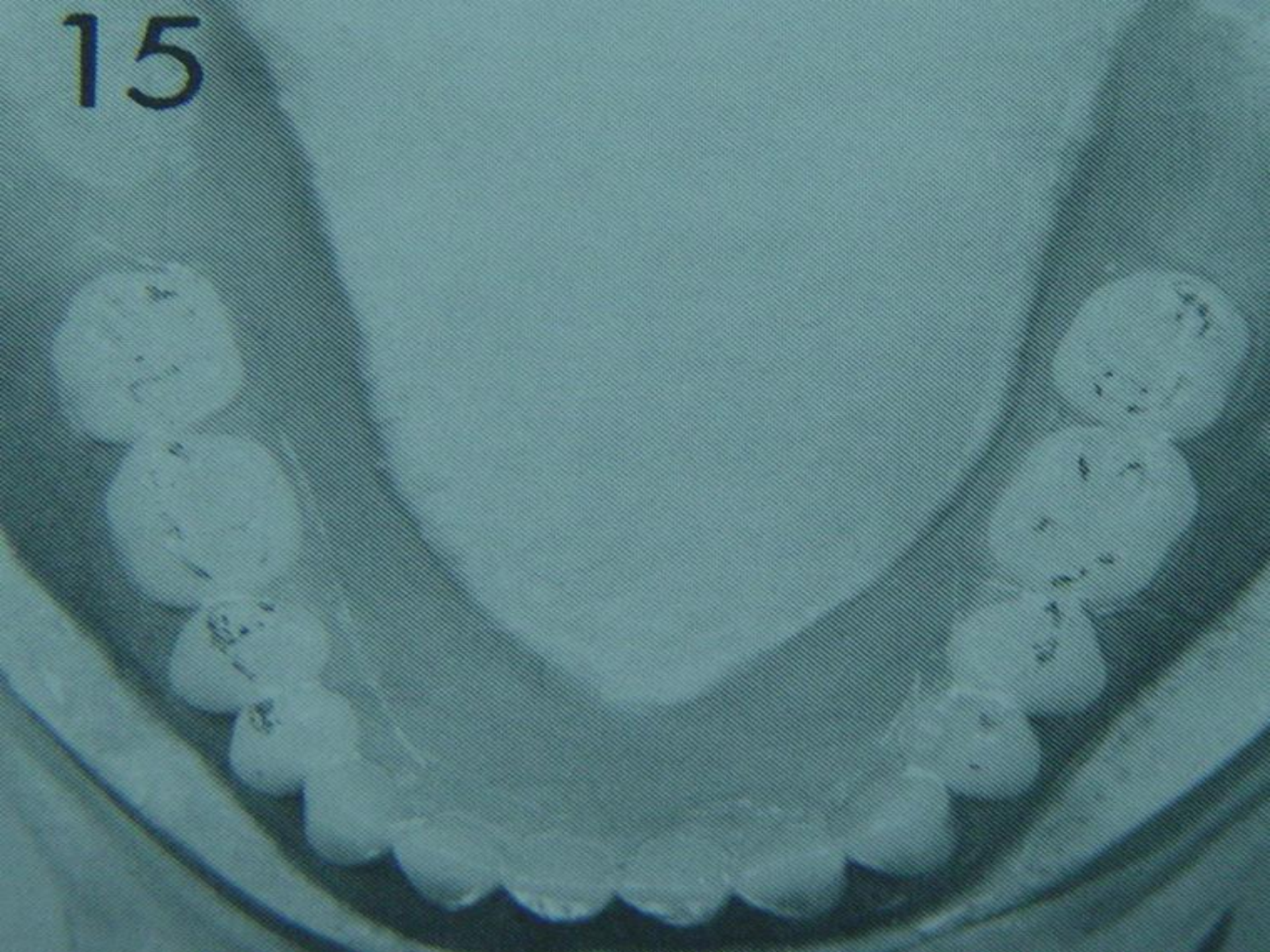
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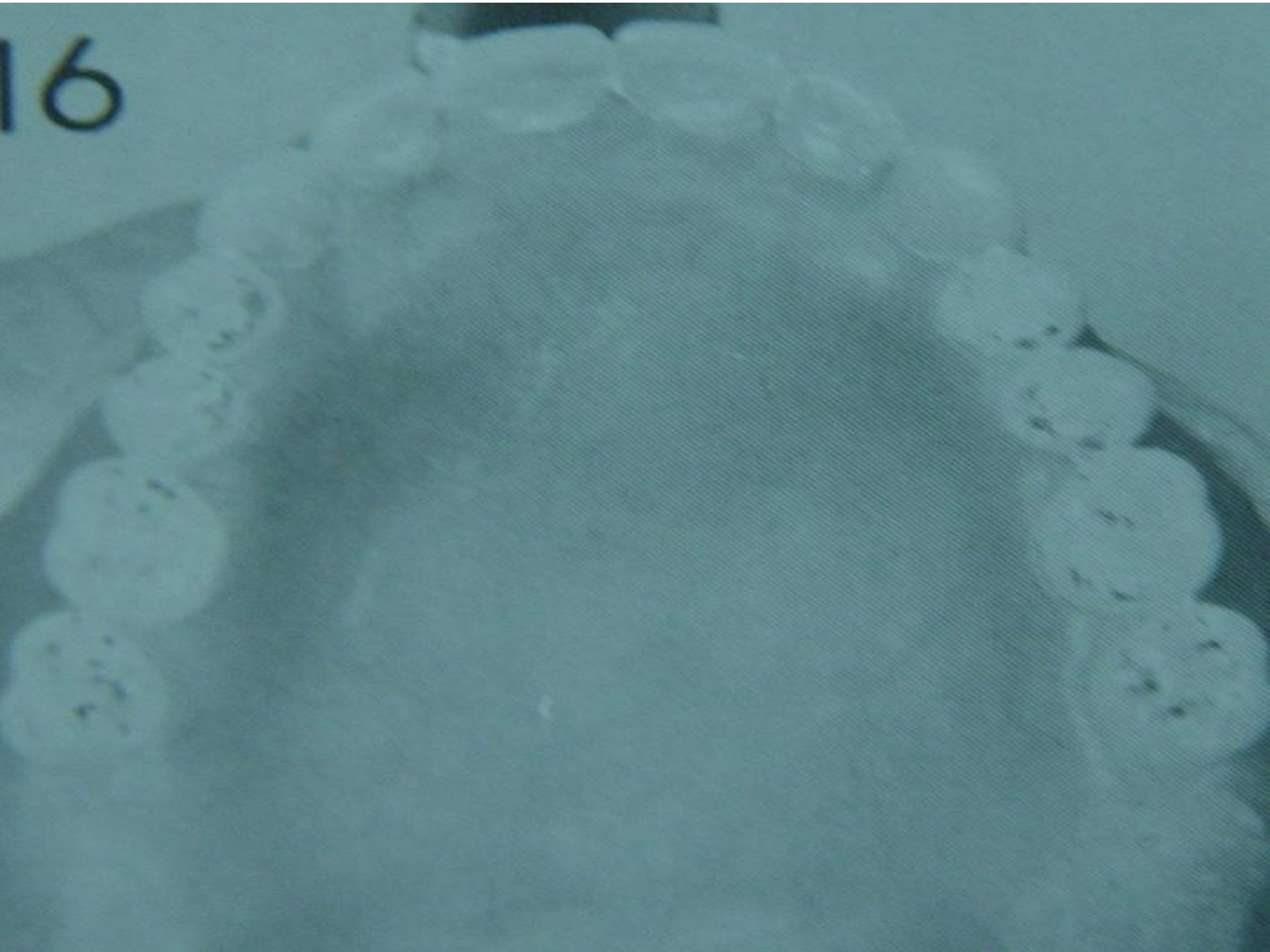
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Adjust the working relation:

Loosen the centric locks and use blue articulating paper.

As a rule in selective grinding the centric holding cusps are not ground. These are : the maxillary lingual cusps and the mandibular buccal cusps.

These cusps are essential to maintain the recorded vertical dimension.

If interferences exists in the working side reduce either the upper buccal cusps or the lower lingual cusps. This is called B.U.L.L. Rule.

In the bull rule reduce the lingual inclines of the upper buccal cusp and the buccal inclines of the lower lingual cusps.

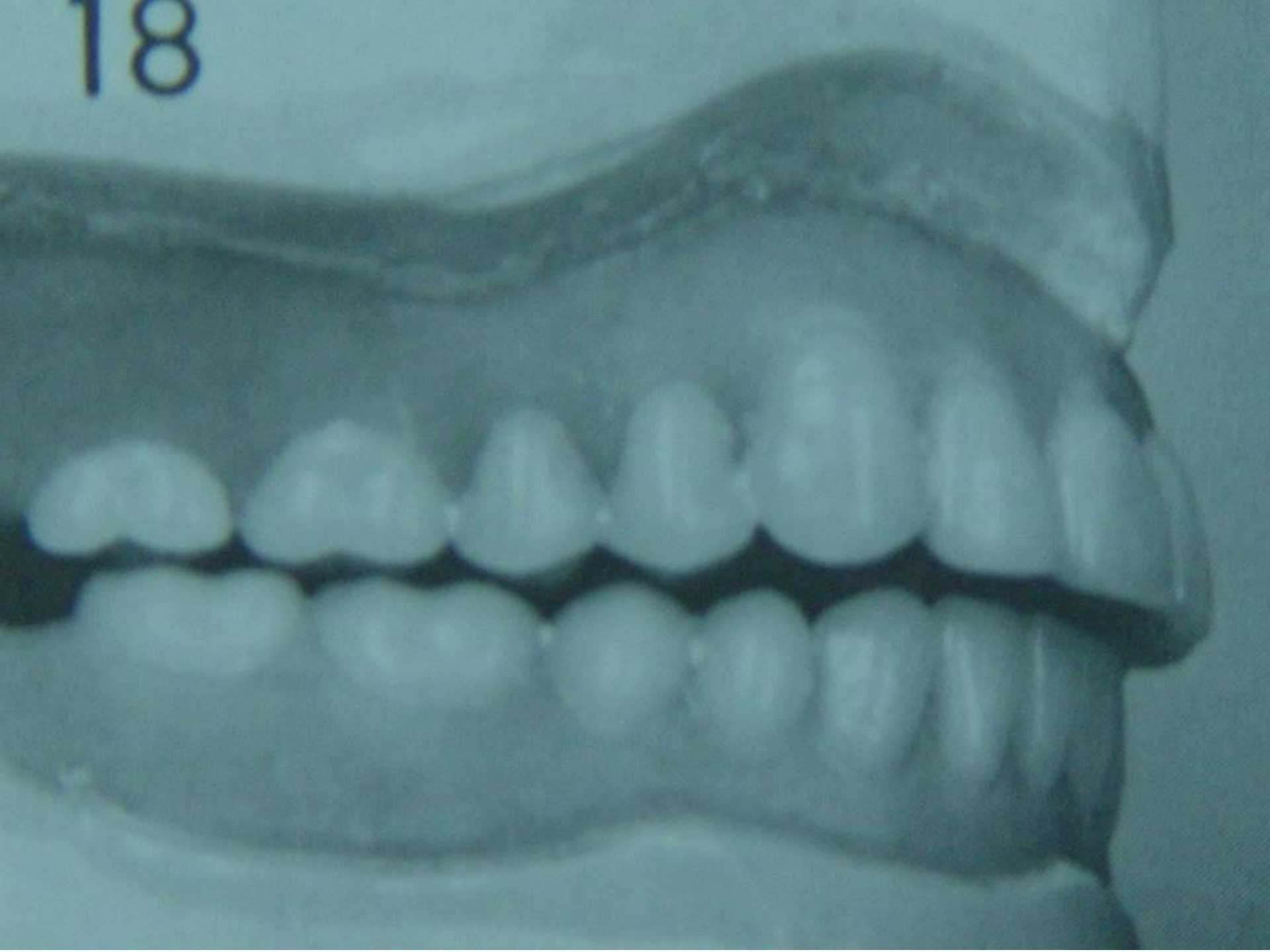
Adjust the balancing relation:

Rule : **If interference exists on the balancing side reduce the lingual slope of the lower buccal cusp. The lingual buccal cusp is a centric holding cusp so grind carefully and do not reduce the cusp tip.**

Adjust protrusive relations

a. If the anterior teeth have heavy contact with no contact on the posterior teeth, grind the labial surface of the lower anterior and the palatal surface of the upper anteriors.

b. If heavy posterior contact exists with no anterior contact reduce the distal inclines of the maxillary cusps and the mesial inclines of the mandibular cusps.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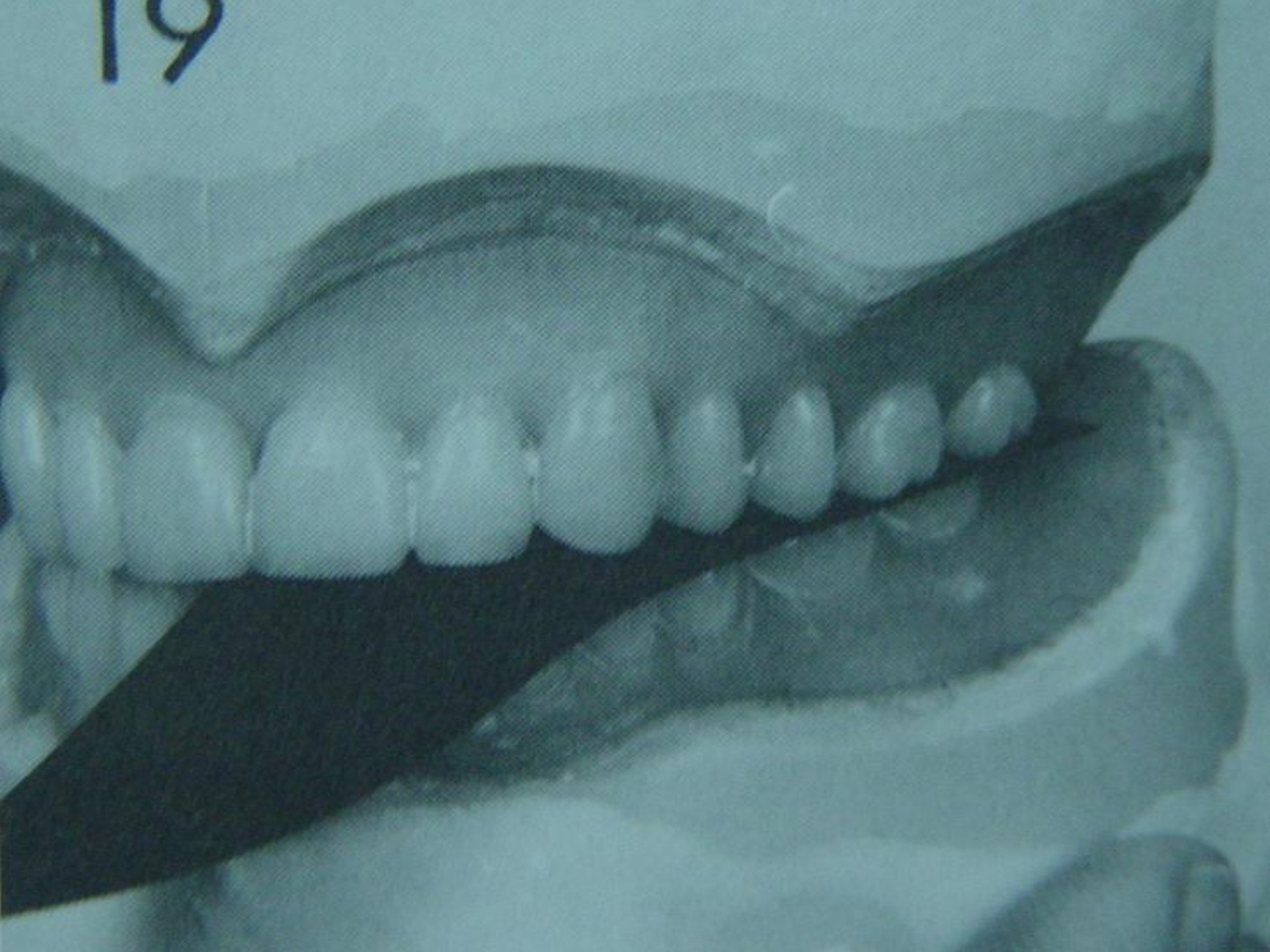

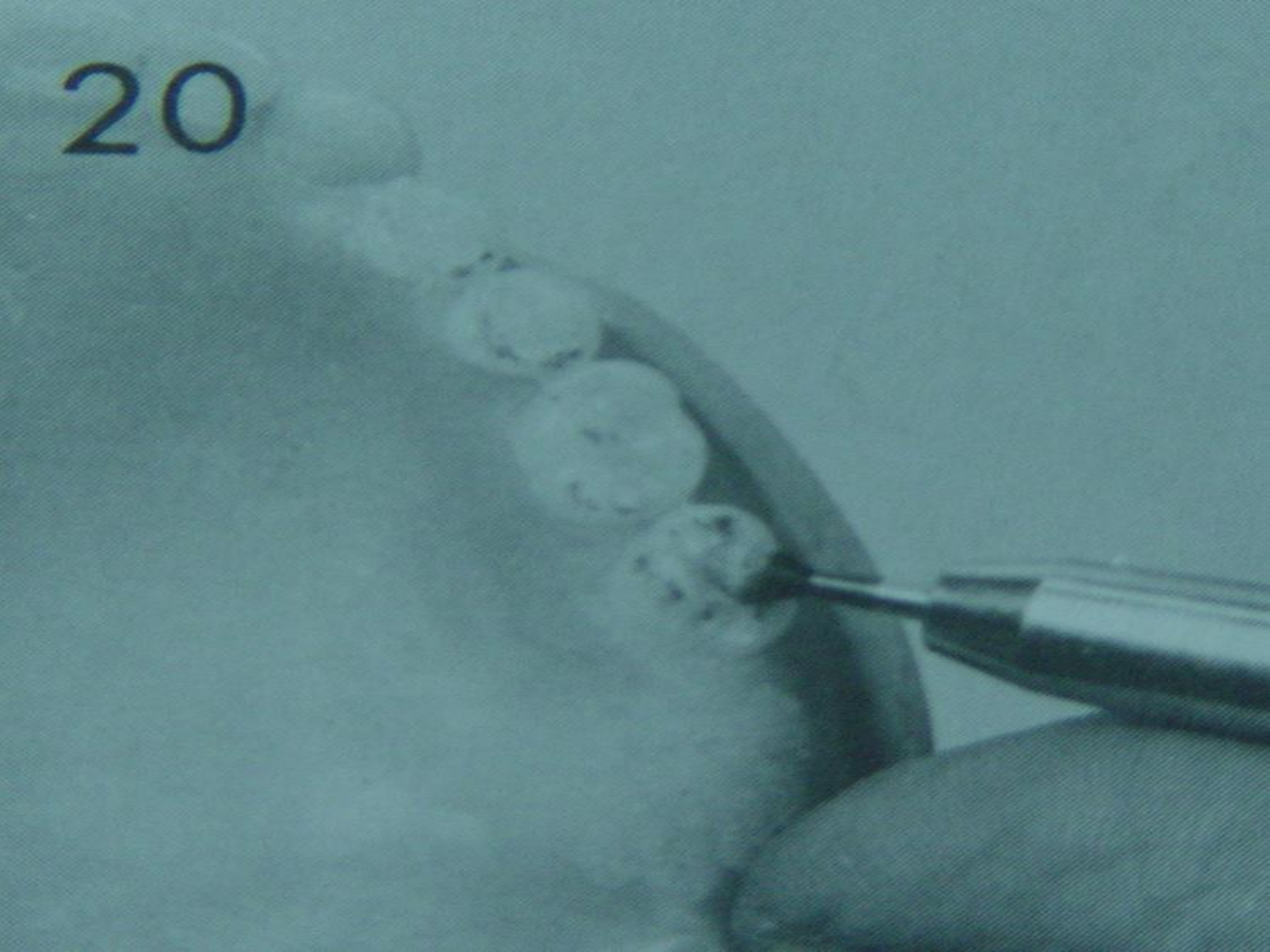
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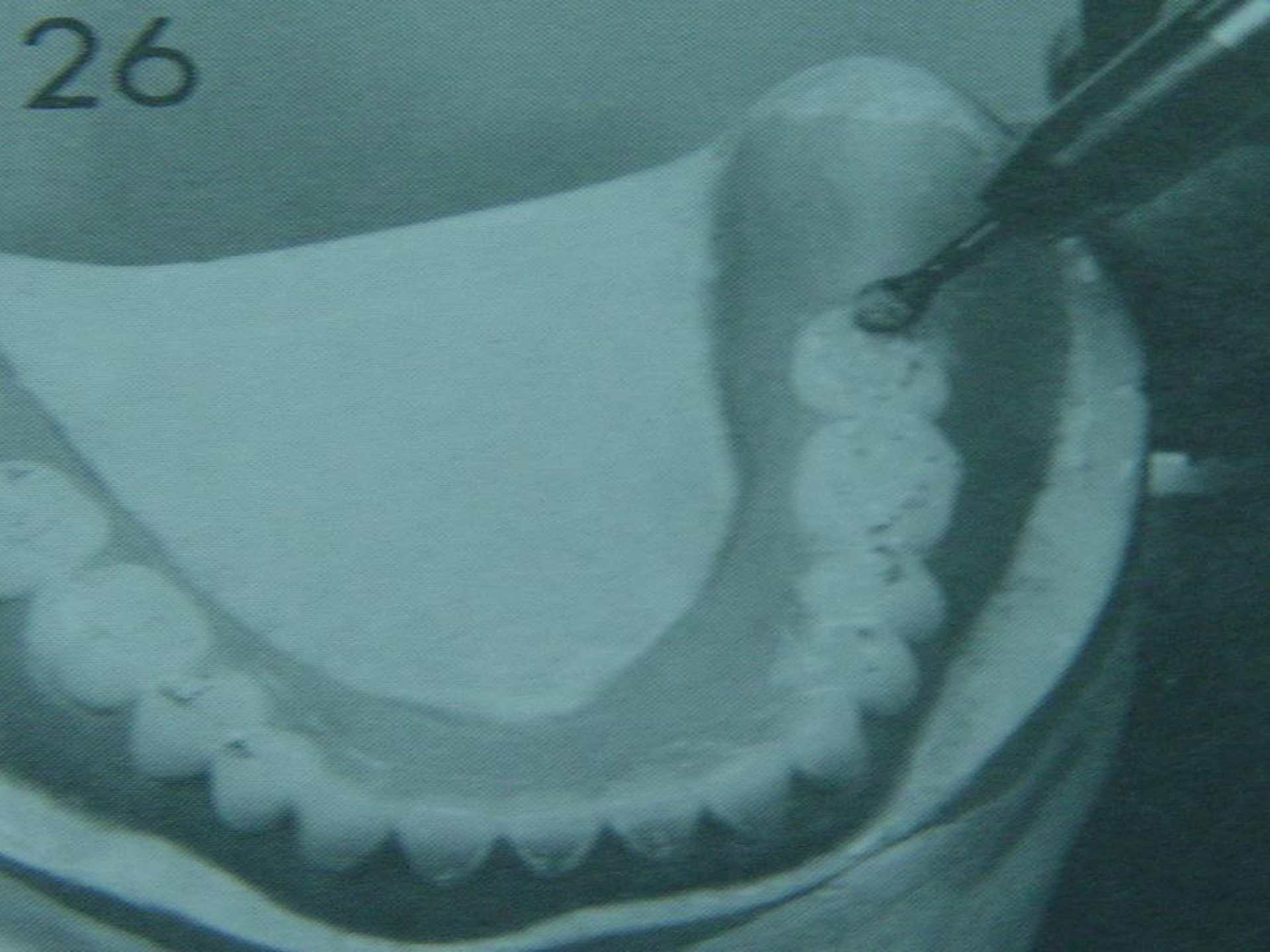
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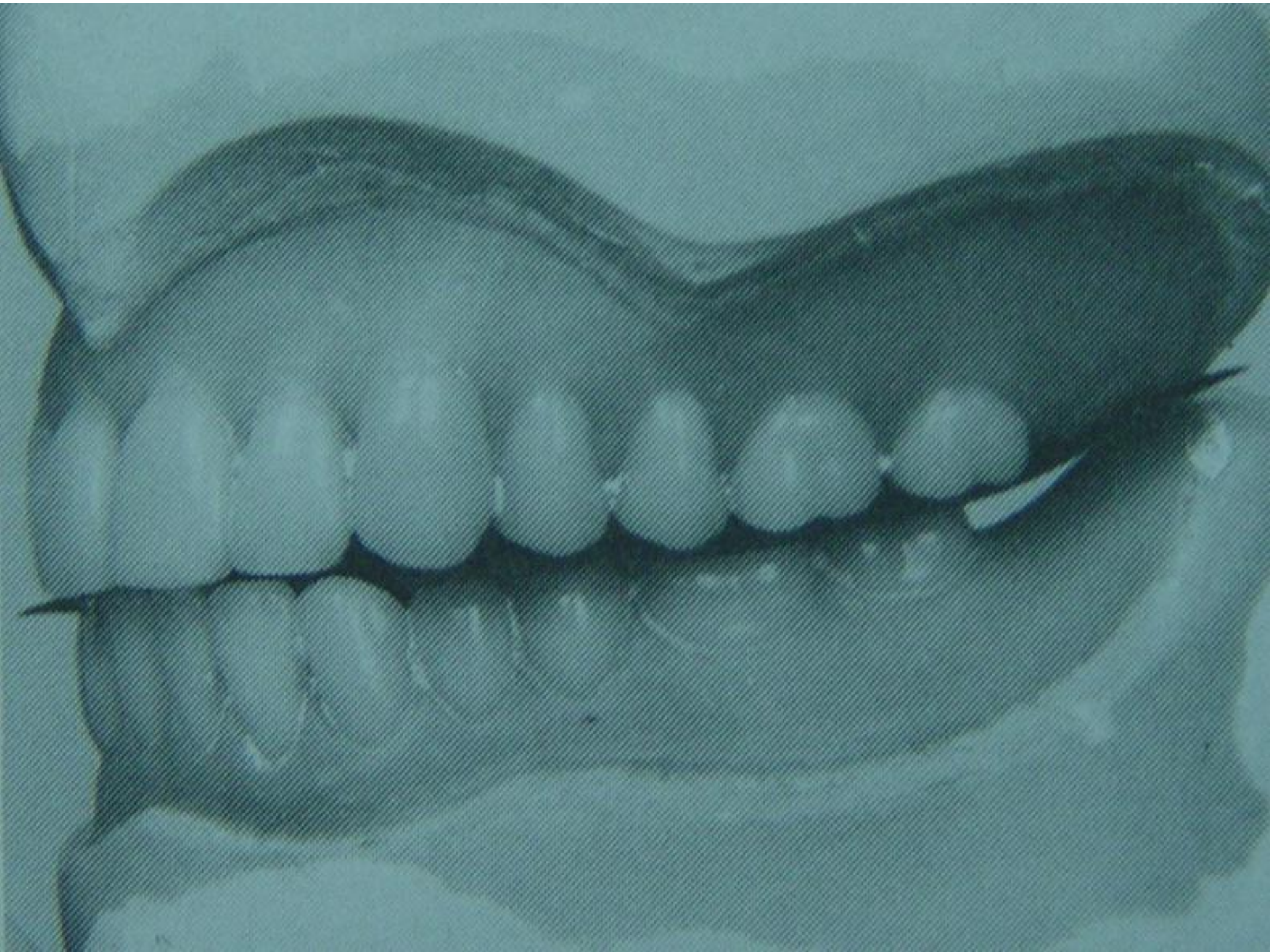
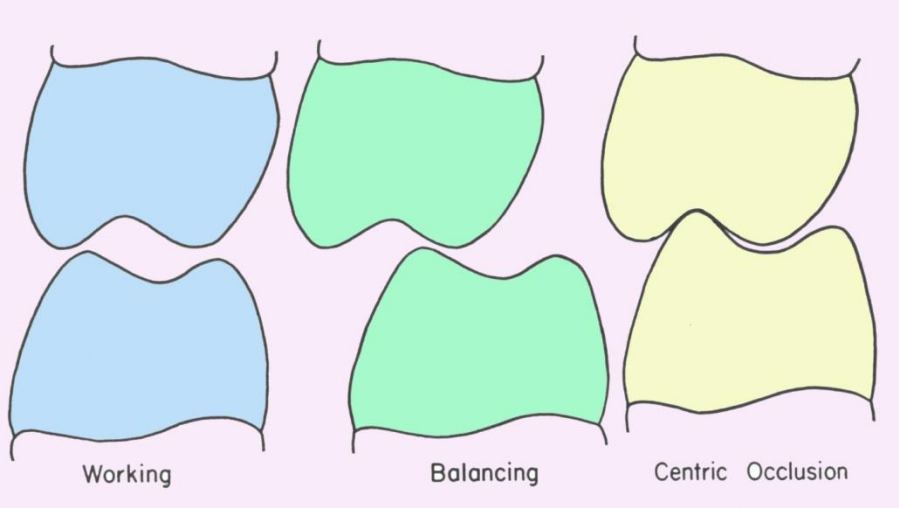


Perfection of occlusion



Carborundum paste milling:

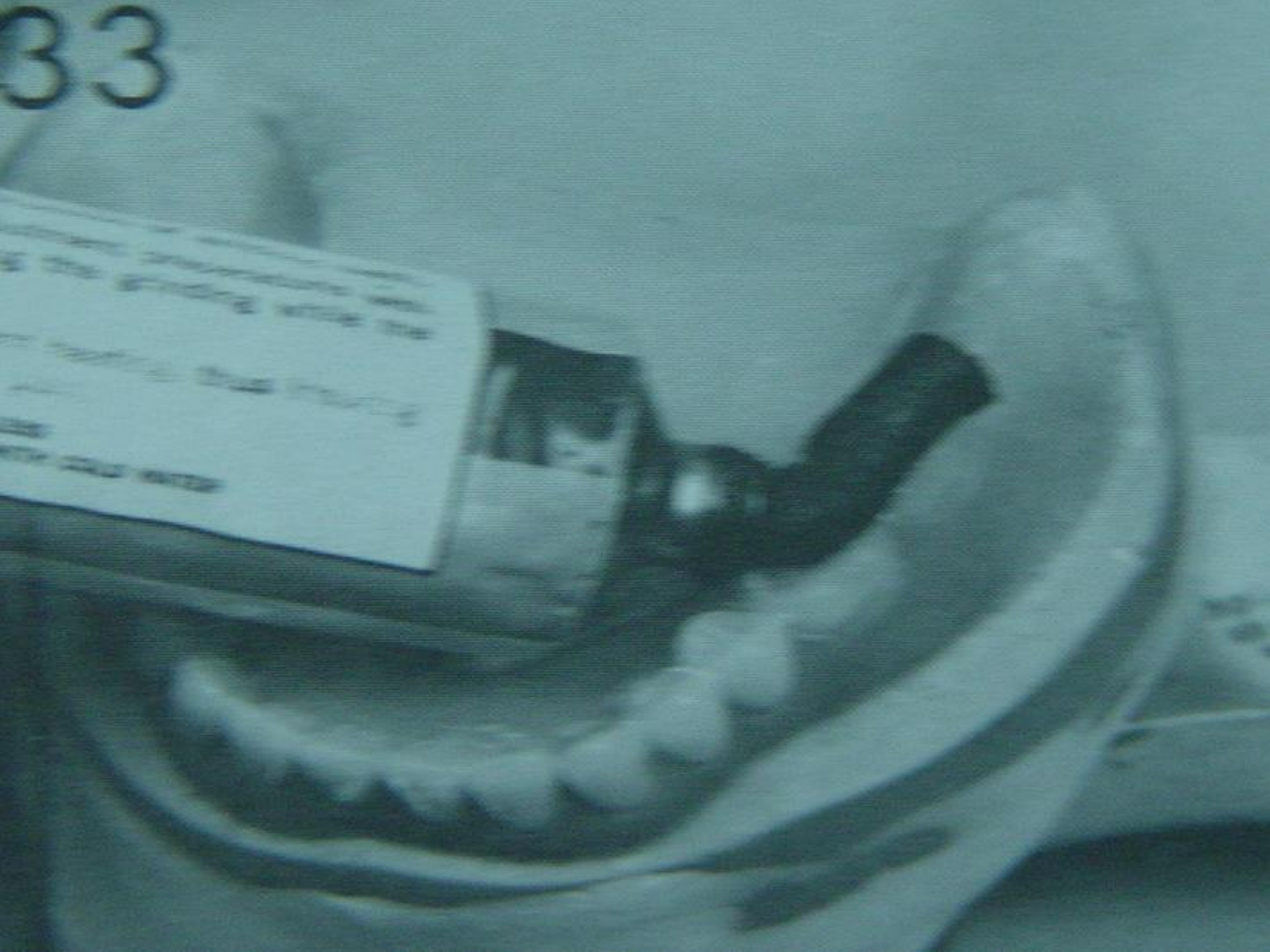
The articulator is moved through all the excursive movements using carborundum paste to smooth the various gliding surface of the teeth. Milling must be done lightly to prevent losing balancing contacts which might decrease the vertical dimension.

a. Move the articulator into right lateral, left lateral and protrusive movements.

b. Move the articulator in a circular movement.

Use light strokes do not force or press.

When milling is completed remove all traces of carborundum. The ground surfaces of the teeth must be polished when grinding has been completed.

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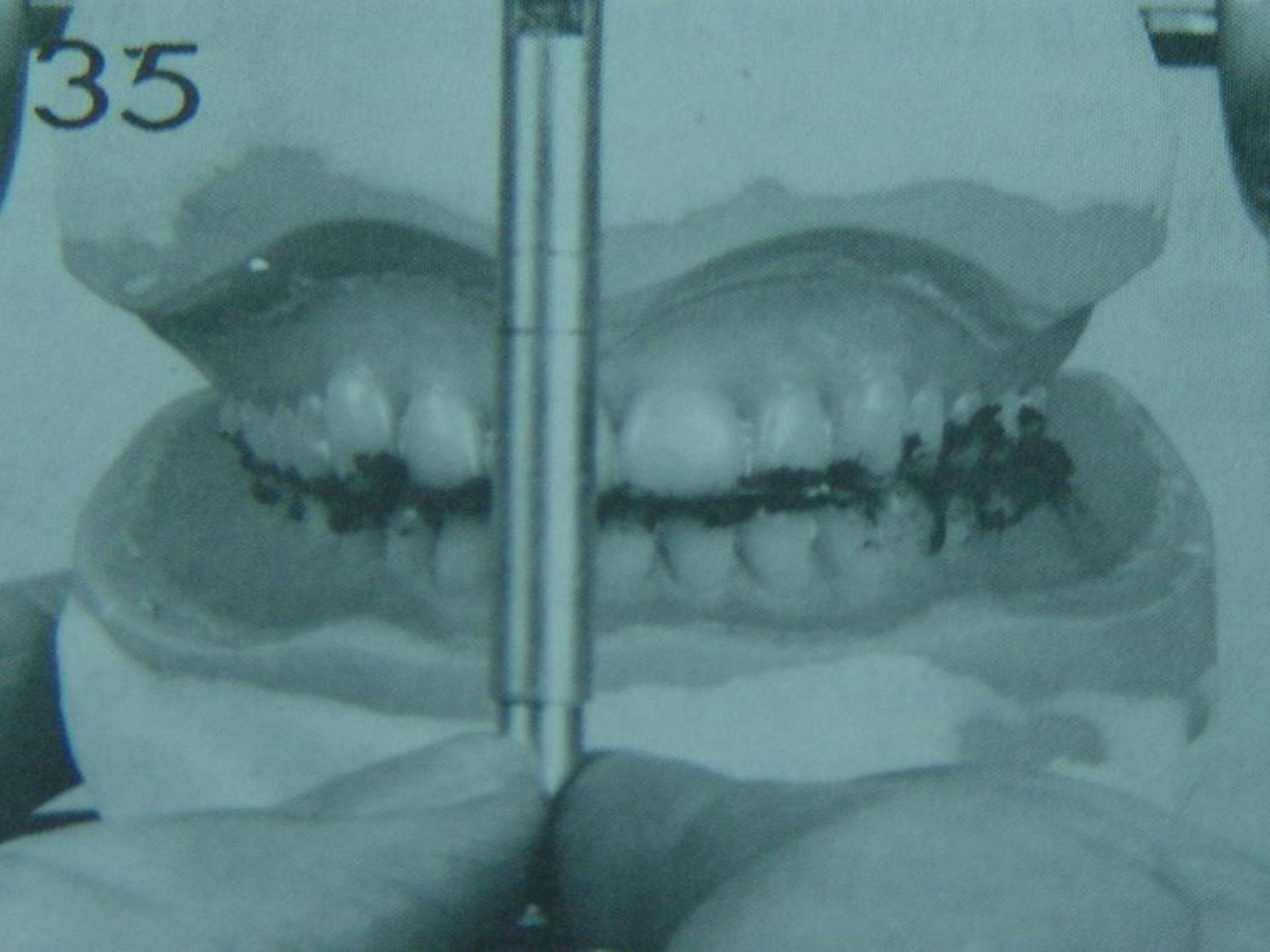
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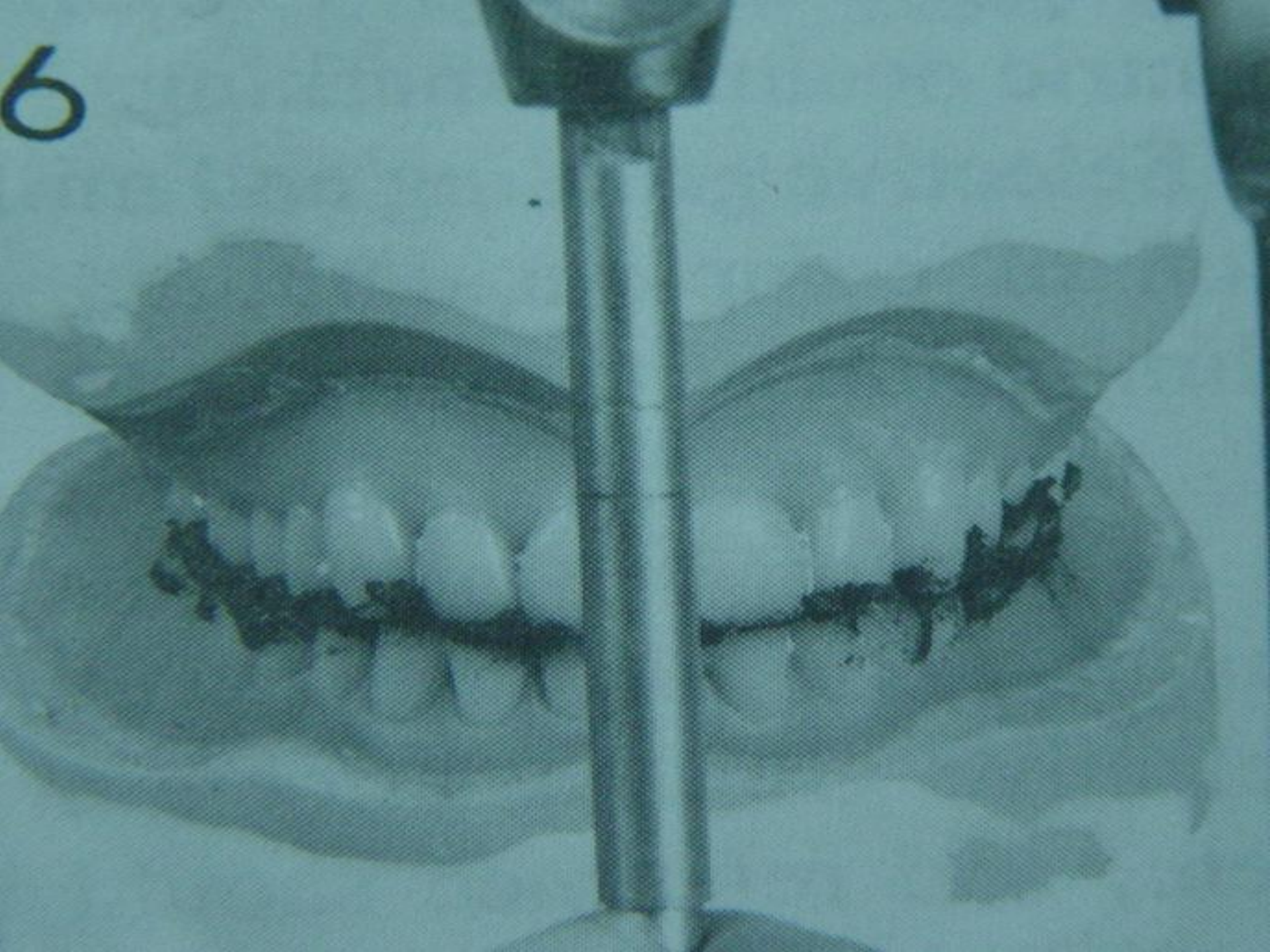
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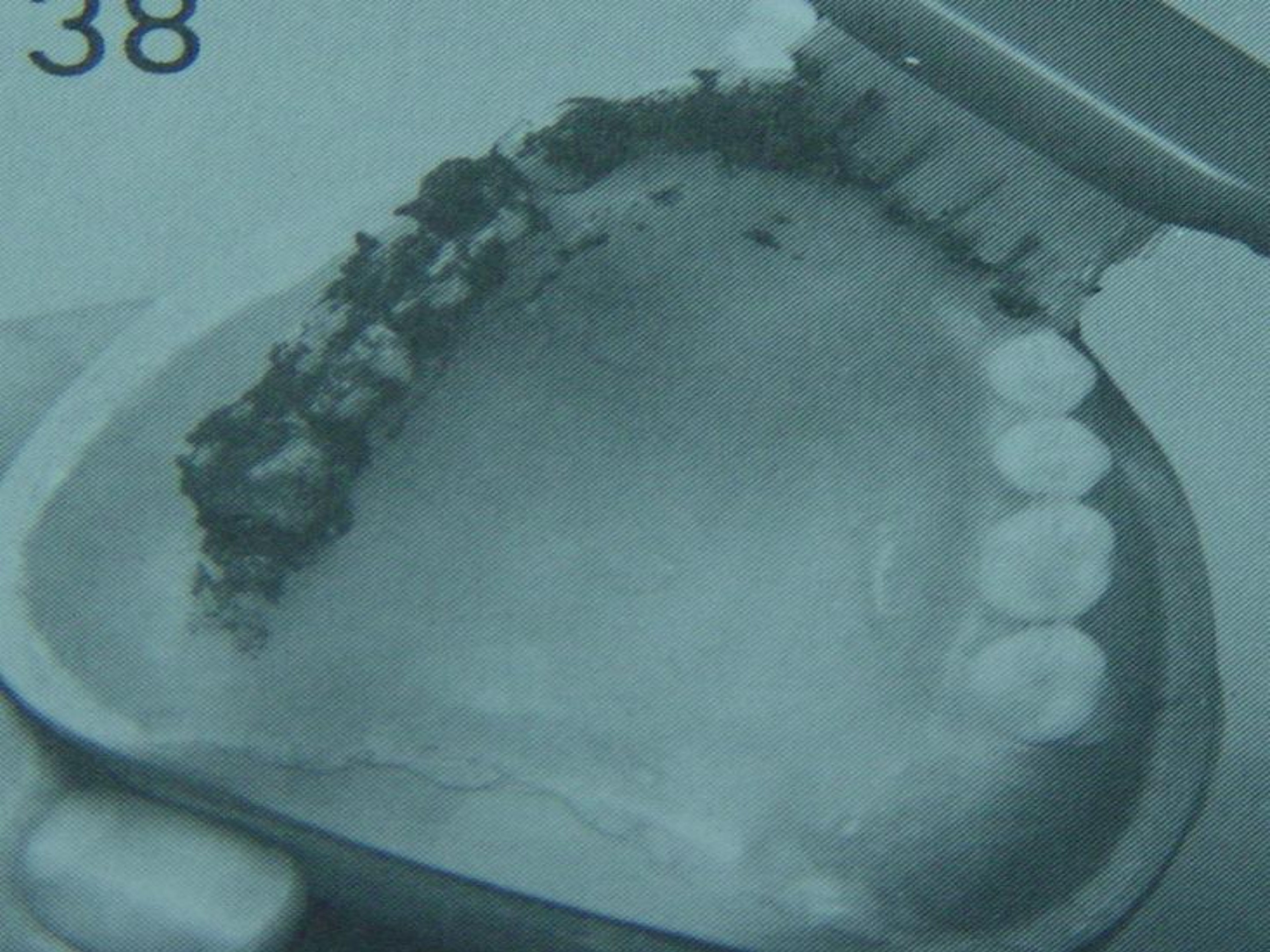

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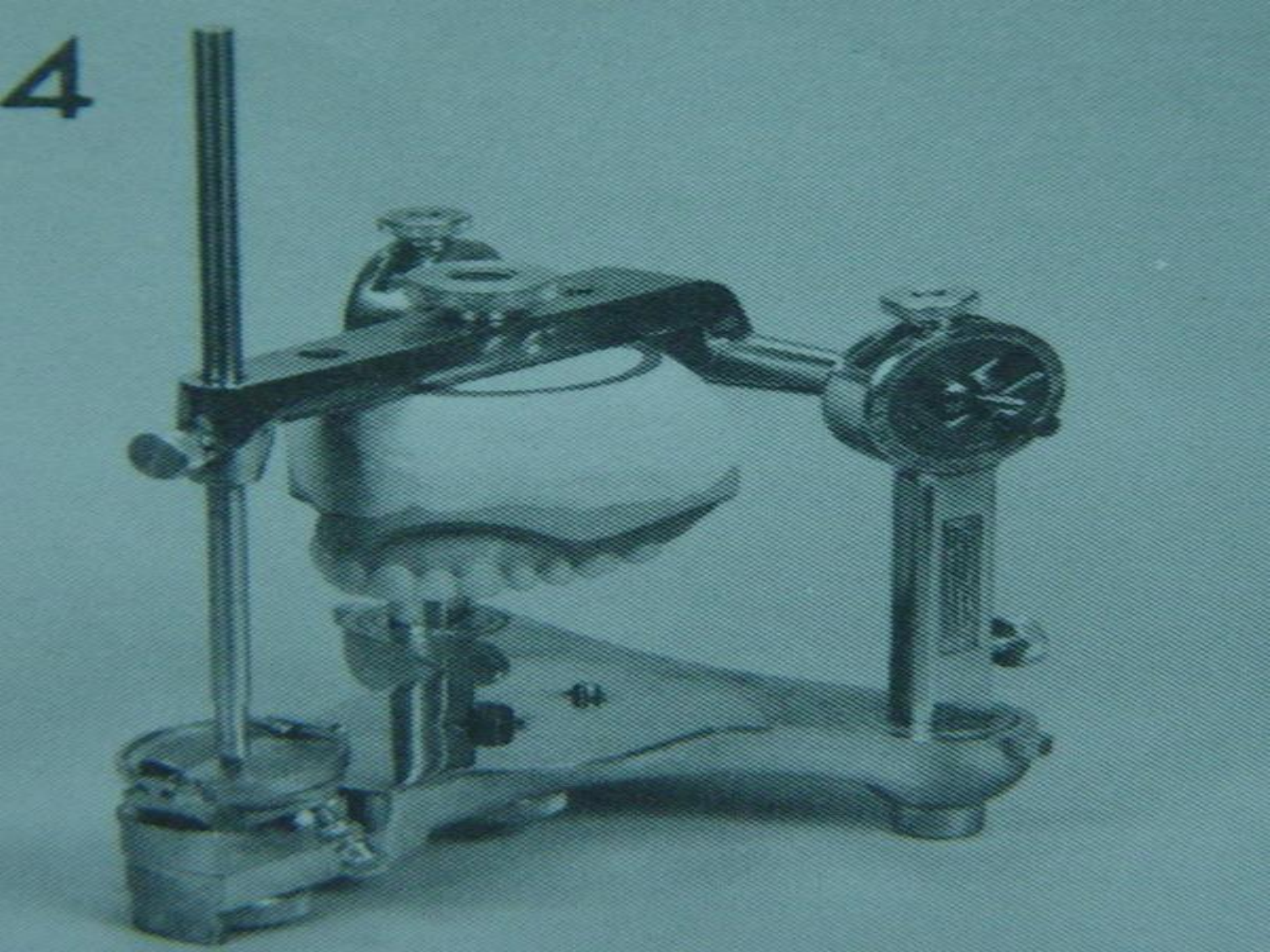

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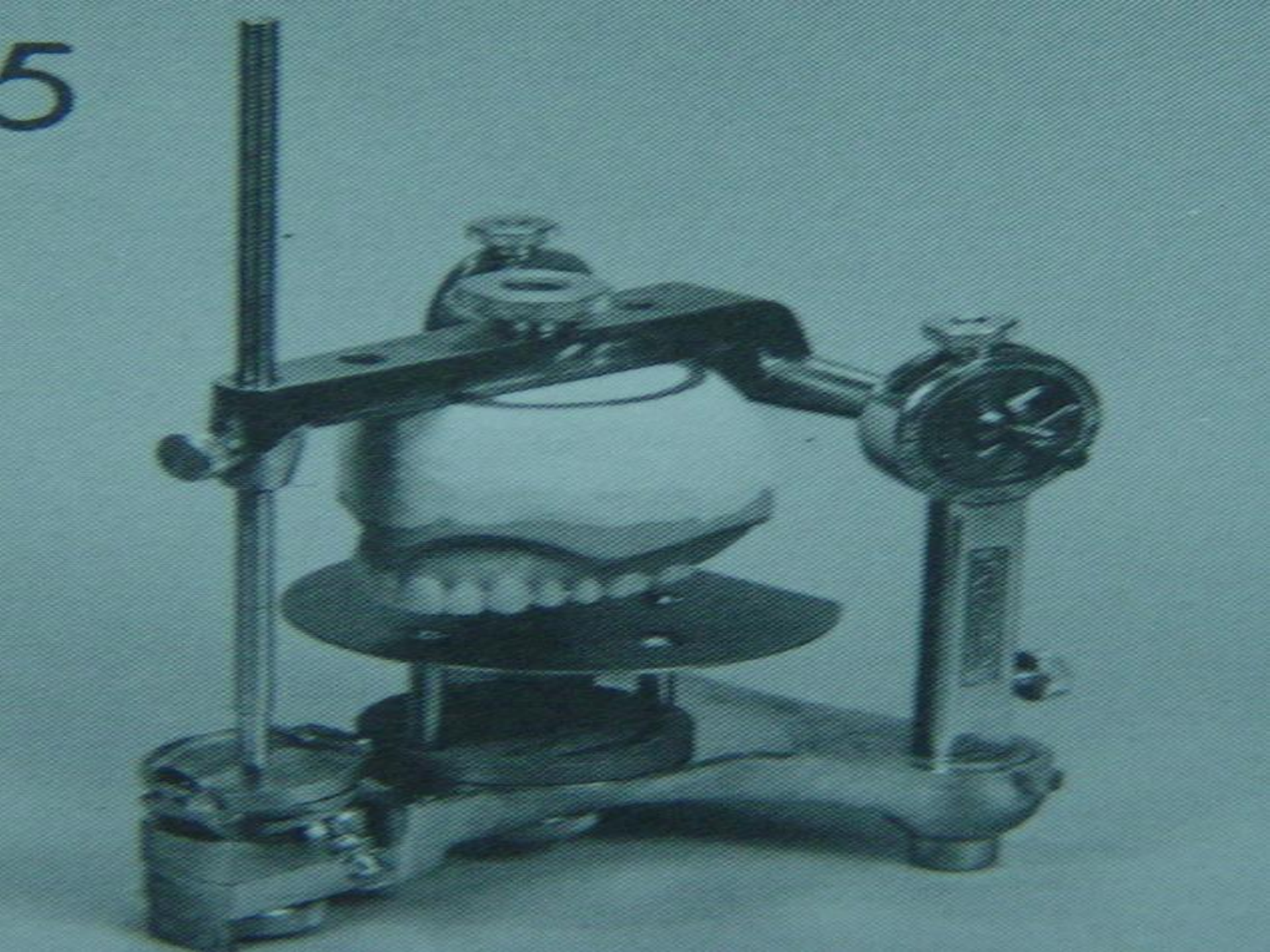

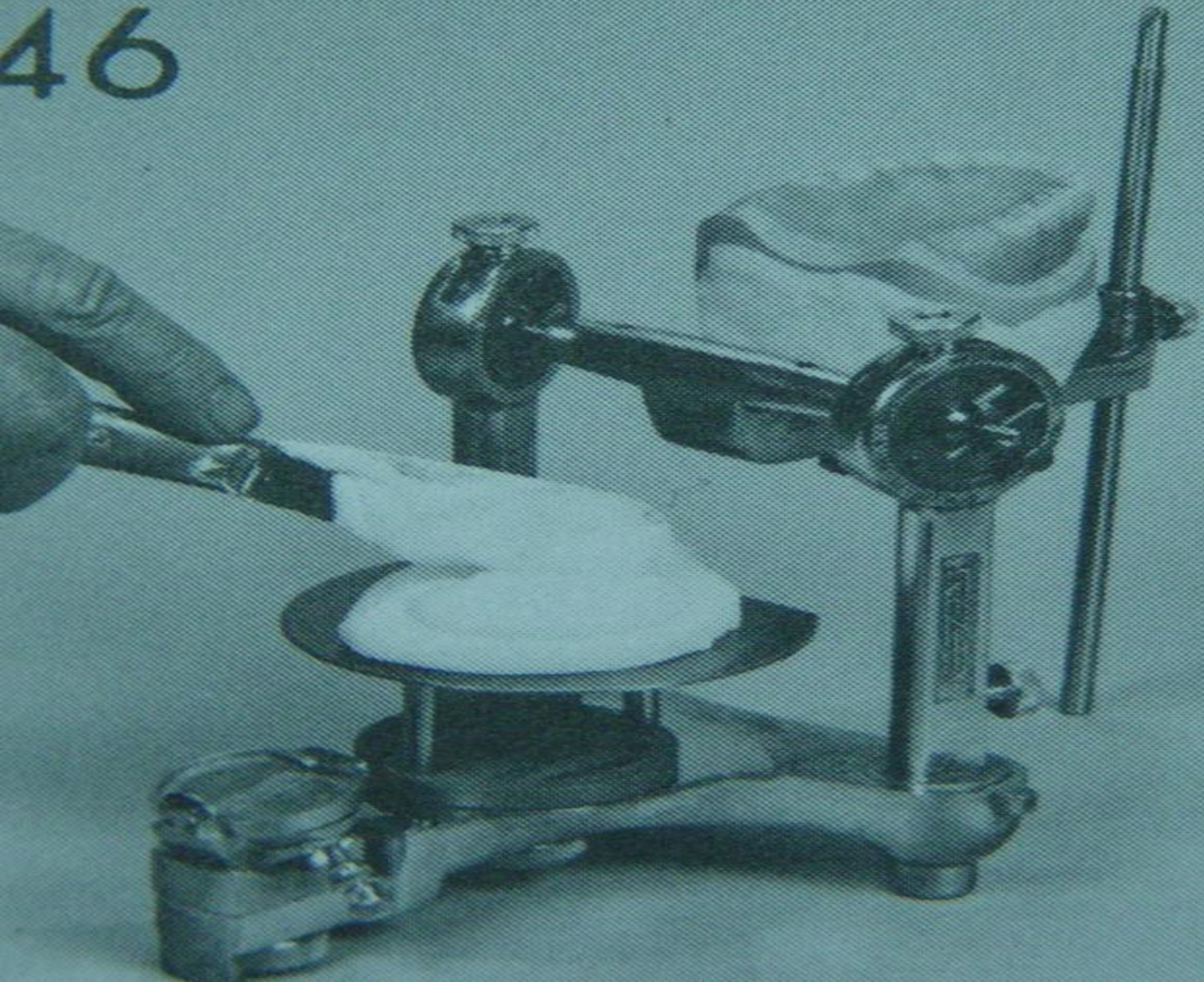

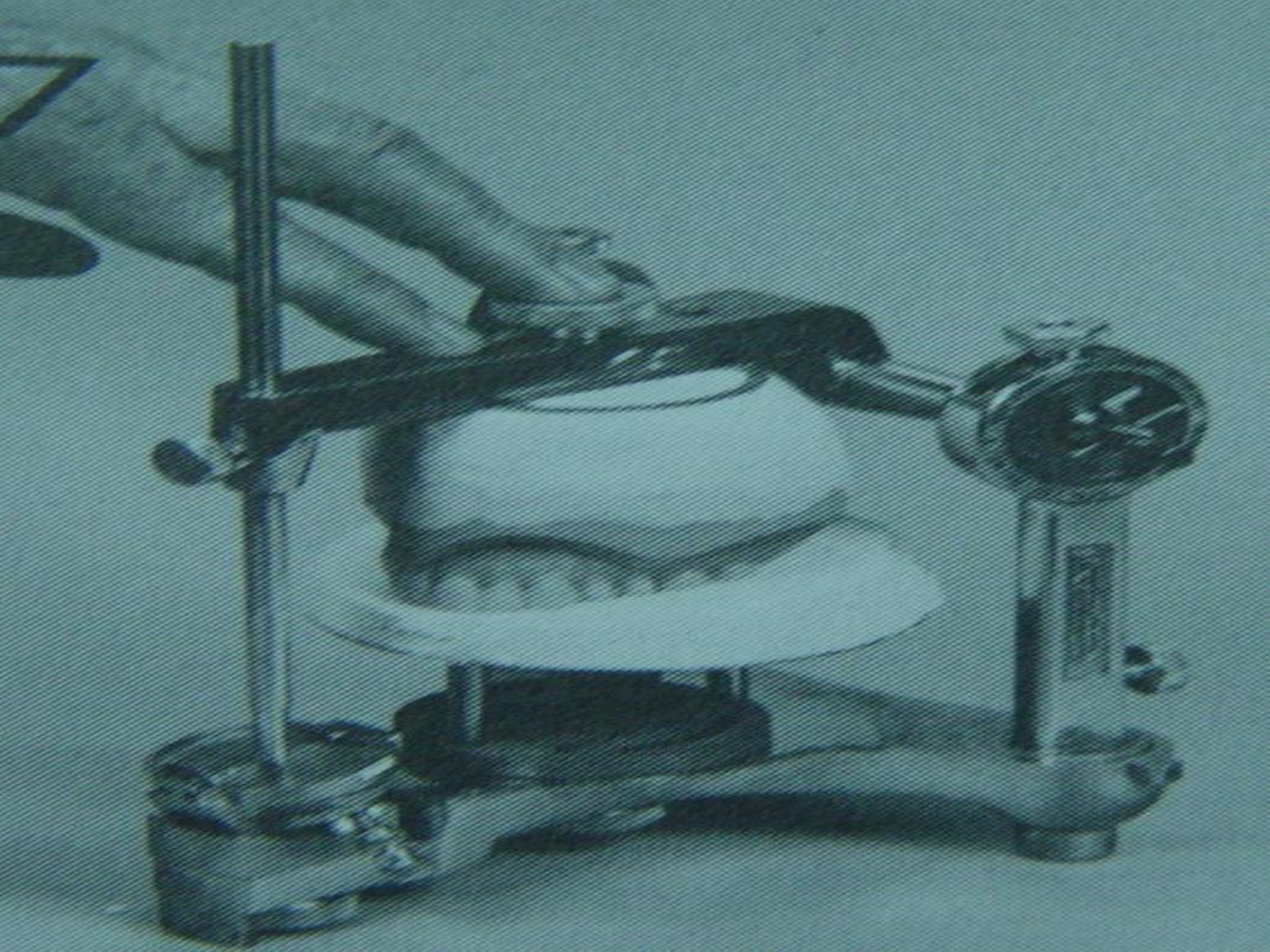

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